FLIGHT

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Review of the machines at the London Aerodrome, Hendon, at the Naval and Military Meeting last Saturday.—General view of the aeroplanes lined up.

EDITORIAL COMMENT.

An Object-Lesson from France.

It is far from our wish or intention to preach from the text of the pessimist-critic who can see no good in his own country and the burden of whose sermon is that every other nation does the things that are right, the while our own people and authorities allow things to go to the "demnition bow-wows." On the contrary, we have enough of robust faith in the British characteristic of attaining the goal ultimately to believe that we are by no means out of the race in comparison with our rivals, whether that comparison be taken as it affects us industrially or in the matter of armaments or in any other direction that may be chosen for the purpose. But because we think that way is no reason why we should allow insularity to ignore the object-lessons which are presented to us by the doings of others. It is by watching those doings and assimilating what they teach that we learn the things of which we are ignorant, the while, on the other hand, others by the same process are learning from us. Particularly in matters affecting aviation is this doctrine true at the moment. We have made progress—much progress—in the learning and understanding of the many complex problems which beset the still infant science of flight. Indeed, we have gone so far along the road that we may now say in all sincerity that there are things connected with aviation which we understand better than some at least of our most active competitors, and the knowledge of which we can exchange for the tangible results of their own investigation. To put the matter in a nut-shell, the science, *per se*, is as well understood by our own constructors as by those of any other nation, and though we are in common with others still in process of learning, we are at least advancing step for step with them.

When, however, we come to consider the application of that knowledge to the most important phase of the aerial movement—its bearing on national defence—we are driven to the conclusion that in spite of all that has been done, and is in process of doing, we still lag woefully behind. We say this with the fullest appreciation of what has been done by our authorities, and with a sense of the intense keenness which the *personnel* of the Royal Flying Corps have brought to bear on their work. What is lacking, to our way of thinking, is the want of a real public apprehension of what is taking place abroad, which can best be described as an absence of a true sense of proportion, and a lack of knowledge of what others are doing. The past week has brought us as eloquent an object-lesson from France of our hopeless inferiority in the air, translated into terms of defence. At Villacoublay, a few days ago, the French War Minister, M. Millerand, held what has been described in the French papers as the first serious aerial review. No less than seventy-two aeroplanes, complete with motor supply wagons and all the equipment necessary for active service in the field, were paraded for his inspection. And these were no carpet-knights of the air, for each and every one of these machines had flown at least a thousand miles without serious mishap during the course of the recent manœuvres, and, after the Minister's inspection, most of them proceeded by way of the air, in the most matter-of-fact sort of manner, to their various stations in every part of France, and, so far as the records take us, they all arrived without delay or mishap at their several destinations.

It is difficult for us here in England, where the problems of aerial defence are but imperfectly understood by the average citizen to adequately realise what this means. Seventy-two efficient aeroplanes, complete with every accessory and adjunct, all ready for instant flight—a bigger fleet than we shall possess all told for the next twelve months—and this only a moiety of France's full aerial power! We do not propose to argue that the exigencies of our own Services necessarily calls for an aerial fleet equal to that of France or of any other first-class military power. That is a question of strategic requirements upon which we do not feel ourselves competent or called upon to offer a definite opinion so we refrain. But a few days ago it was laid down by a famous general officer that air-craft had made the possibility of a successful invasion of these islands much more remote than it had ever been. It is not a matter for the professional strategist to demonstrate that theoretical air-craft will not stave off a successful invasion—that is an elementary fact which the meanest intellect is capable of grasping. The air-craft that are to make the attempt of the invader abortive must be *in esse*—for them merely to be *in posse* will not avail in the hour of stress.

As we have said already, while we fully appreciate the efforts of those who, in the face of discouragement, have done their level best with the all too limited means at their disposal to evolve as an auxiliary to our Army and Navy an efficient air-corps, we feel that we should be doing less than our duty did we not call attention upon every possible occasion to the backwardness of this country in the matter of its aerial defences. It is only by taking the moral of such significant happenings as this aerial review by M. Millerand that we can hope to adequately impress upon the public and the authorities how urgently necessary it is, how absolutely essential for the security of the country, that we should arrive at a just and full appreciation of the enormous importance to which air-craft have attained in the organisation of Continental armies. That moral is so patently manifest that it needs not repetition.

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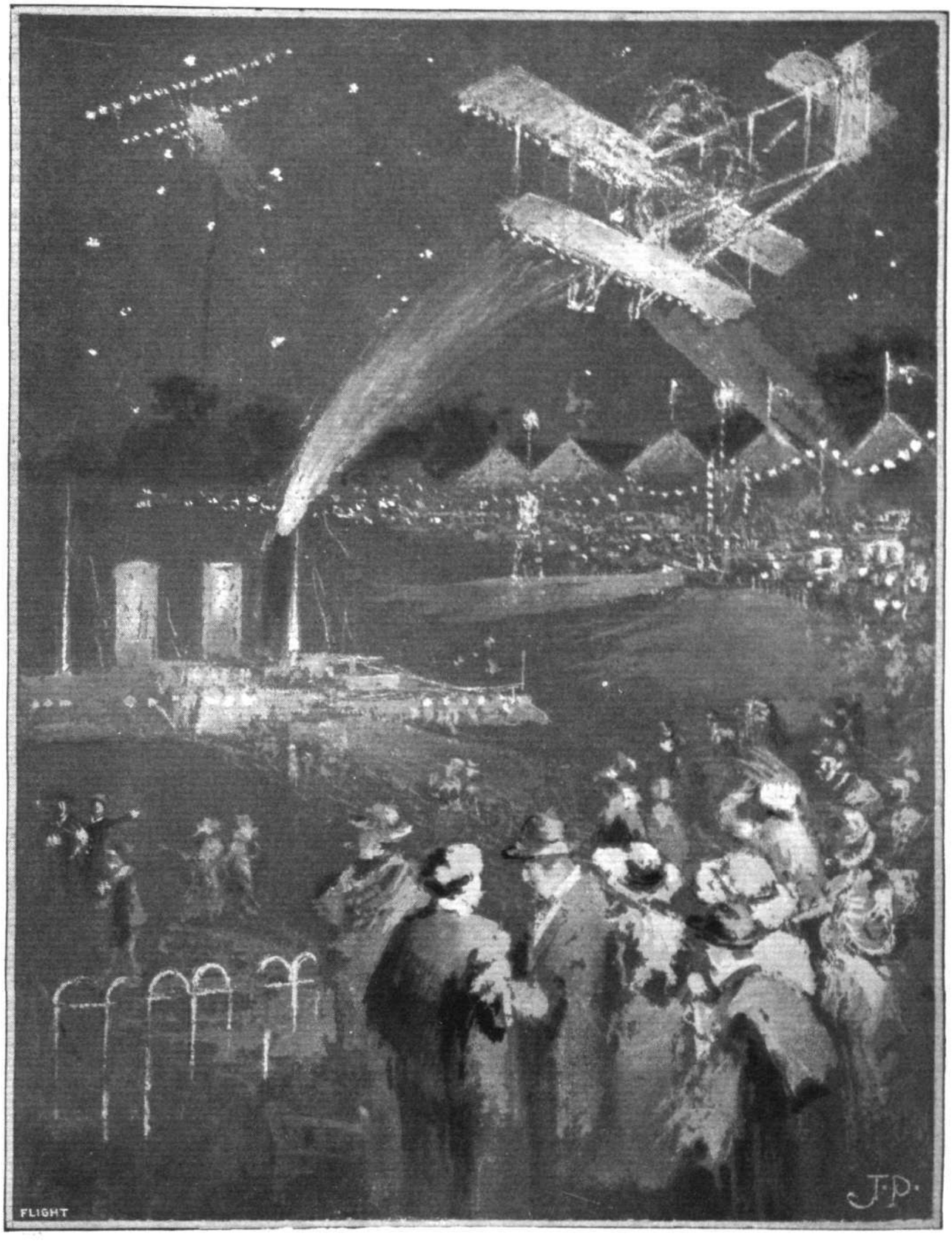
To India by Air.

So far from the project for a flight from London to India, to which reference was made in our editorial columns earlier in the year, having been dropped, it is now announced that an attempt to carry it out will probably be made before the end of the year. Several native Indian princes are taking a very active interest in the arrangements, and by way of showing their practical sympathy in the scheme have promised substantial money prizes. With the able co-operation of the Royal Geographical Society, the route has been mapped out, and from the particulars given on page 898 it will be seen that it is almost direct from London to Karachi. The question of supplies has been thoroughly gone into, and it is proposed that the daily stages should be of 400 miles, so that twelve days would be required for the trip. All that apparently remains, therefore, is to select the most favourable time for the attempt. So far as we are able to see, there are no practical difficulties in the way of success, and from the point of view that it would afford a far-reaching and widely understood demonstration of the perfection to which the aeroplane has attained, the project has our heartiest sympathy.



A post impression of Thursday week's Illuminated Flying Meeting at the London Aerodrome, Hendon.—Capt. Tyrer, as a passenger on a Henry Farman biplane, throws bombs on a dummy battleship. Another biplane, its leading edge starred with lights, forms a new "constellation" at the left top corner.

FLYING AT HENDON.

THERE was quite a gusty wind blowing nearly all Thursday afternoon last week, and very little flying was possible. Two trial flights were made about 6 o'clock, while it was yet light, on the new Grahame-White biplane (piloted by Lewis Turner) and one of the Henry Farmans. About half-past six Raynham arrived from Brooklands on a 70-h.p. Renault-Flanders two-seater monoplane. This machine resembles the earlier models very closely, there being apparently more travel for the wheels and a very pronounced dihedral, while the fuselage is a little wider at the front to accommodate the 8-cylinder V-type engine, the mounting and housing of which are amongst the neatest points of the machine. Lieut. Porte took a short spin around the outskirts of the aerodrome with a lady passenger on the 100-h.p. Anzani-Deperdussin.

Night Flying.

To use an Irishism, "It was a fine day for night flying" on Thursday the 26th ult., when a series of very successful flights were made. Except for one or two experimental essays at Hendon and a few demonstrations under the parental care of the *Daily Mail*, this was the first time that an exhibition proper of illuminated night flying had been given. A large attendance was in evidence at the brightly lit up aerodrome as early as seven o'clock, but the first flight of the meet did not take place till about 8.30 p.m., when Lewis Turner got away on the new G.-W. biplane, which was fitted with a row of small electric lamps under the leading edge of each plane. The machine also carried a port and starboard light and a powerful head lamp, current for all of which was supplied by a set of C.A.V. batteries. From time to time Turner would switch off all the lights, when, owing to the ground mist, intensified by the reflection of the moonlight, the rattle of the 50-h.p. Gnome was the only indication of his position. The machine circled the aerodrome for about 10 mins., after which a perfect landing was made in front of the enclosure. It was a considerable responsibility to make the first flight at the first Illuminated Aerial Exhibition, and great credit is due to Mr. Lewis Turner for his excellent display and fine finish, particularly in view of the fact that he was piloting an almost new machine.

After a short interval Richard Gates took up the 80-h.p. Gnome-Henry Farman, also outlined with electric lamps, and it was announced that he would "Morse" messages to the judges' box by means of a searchlight on the machine. Various versions of these messages have been published, but it certainly appears to the writer that a new system of signalling, of remarkable speed, must have been devised for the purpose. During Gates' flight, Grahame-White ascended on his own works-built biplane and executed some effective manœuvres, the most sensational of which was when he swooped towards the spectators with the headlight only illuminated, and then switching that off absolutely disappeared into the gloom. Once during the evening, from the writer's position on the field, a darkened machine passed right across the face of the moon—quite a thrilling experience, and one of the most effective bits of the evening.

Shortly after 9 o'clock Marcel Desoutter took out the Gordon Bennett 50-h.p. Gnome-Blériot, which was fitted with a head and a tail lamp *and* a Klaxon horn. His engine was not pulling very well and he flew rather low, but what he lacked in light he made up in noise, the sixpenny and shilling enclosures going wild with delight as he passed over them tooting away on this well-known road clearer. Even the occupants of the half-crown enclosure "could scarce forbear to cheer" at his landing.

Sydney Pickles then essayed a trip on the 35-h.p. Anzani-Caudron biplane—brilliantly lit up—but was prevented from rising more than about 10 feet by the formation of ice in and around his carburettor. The tiny machine would have looked extremely effective in the air after the great Henry Farmans, and no one was more disappointed than Pickles himself. Travers and Nardini took up the Henry Farman and the Deperdussin respectively and covered several circuits of the aerodrome, after which, a little before 10 o'clock Turner, Louis Noel and Travers, the latter with Capt. Tyrer as passenger, ascended on the Grahame-White and Henry Farman biplanes and flew round and round the ground with their machines fully illuminated. Each time Capt. Tyrer passed over the dummy "Dreadnought," which had been erected in the middle of the ground, he dropped a bomb, and great excitement ensued when the erection was seen to burst into flames. The three machines, which had been simultaneously circling the ground, then descended, after which, during the burning of the "Dreadnought" a fine firework display brought the proceedings to a close. There were several clever set pieces, one of which was a representation of Grahame-White seated in a monoplane. The quality of the flying, while not being of the trick variety, was exceptionally high, the landings being particularly good. Gates' *atterrissage* by the unaided illumination of his own headlight was a very fine exhibition of skilful handling.

Only one suggestion can we offer should the management decide to hold further meetings of this character, and that is that the machines should not be left between the spectators and the fireworks, where for a good many they somewhat spoilt the effect of several of the set pieces.

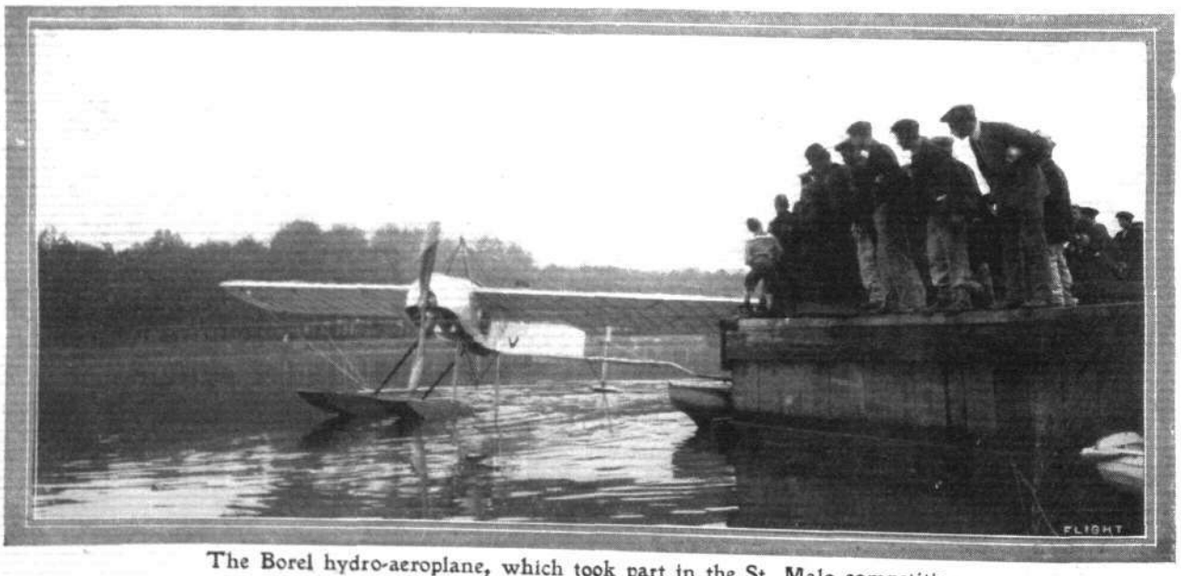
Saturday's Military Meeting.

High gusty winds and mist were responsible for the abandonment of flying at the Naval and Military flying meeting on Saturday.

There was nothing doing for most of the afternoon until Lieut. Parke took out the new G.-W. machine, and made several straights across the ground against the wind. Before and after there was a good deal of galloping around with gun carriages on the part of the military present, and Hamel got away on his own 50-h.p. Blériot, the engine of which was in anything but good tune; once or twice he swooped down almost unpleasantly close to the spectators in the half-crown enclosure, a large number of whom got severe attacks of "cold feet."

On landing, Mr. Hamel was fortunate enough to have Mr. Hall's Blériot No. 38 placed at his disposal, so he proceeded to climb for altitude, the prevailing grey mist giving a weird effect of loneliness to the little machine away ever so high up in the air.

During Hamel's flight, Lieut. Spencer-Grey made several attempts at flight on an Anzani-Deperdussin, but was unable to get it to rise owing to engine trouble.



The Borel hydro-aeroplane, which took part in the St. Malo competition.

FLIGHT

THE EVOLUTION OF THE AERO COMPASS.

By M. B. FIELD and F. A. KING.

WITH the rapid development of cross-country flying, the necessity for an adequate aero compass becomes more and more obvious, and the aviator naturally turns to the nautical navigator for the results of experience gained during many years of hard practical work.

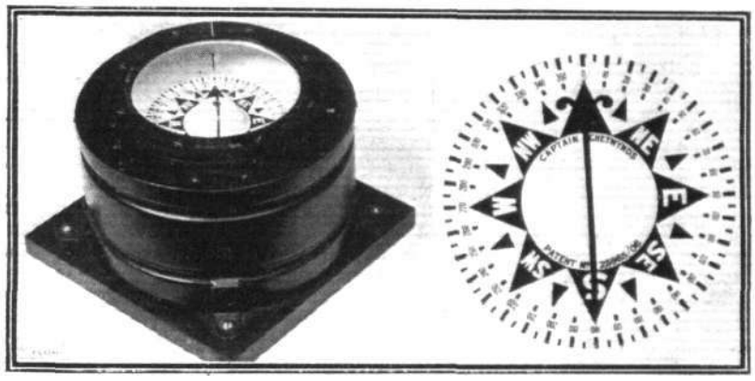
It is true that a marine-type compass as it stands would be most unsuitable on the aeroplane, but nevertheless it embodies the embryo from which the final aero compass must develop.

In nautical work compasses fall under one of two heads—(A) the dry card system and (B) the liquid system.

Practically all dry cards are now constructed on Lord Kelvin's (then Sir William Thomson) original model. The essential characteristics of such a card are :—

(1) Lightness, to eliminate pivot friction errors, and to minimise the deterioration of pivot and jewel consequent on jarring and vibration.

(2) A sufficiently large magnetic moment of the needles, so that the directive couple exerted on the card, when deflected through



The compass complete, and the card and magnetic system.

very small angles from its true position, is great in comparison with the pivot frictional torque.

(3) A long period of vibration to secure steadiness.

Now, increase in the strength of the needles decreases the period of oscillation, so that condition (2) militates against condition (3).

The period of oscillation is increased by increasing the moment of inertia of the moving card, but this again militates against condition (1).

Thus one is faced by a number of conflicting conditions. Sir Wm. Thomson solved the difficulty by producing an exceedingly light card, but with the mass so distributed that its moment of inertia was great in relation to the magnetic moment, while the directive force again was great in relation to the exceedingly reduced pivot friction, even for very small angles of deviation.

It is obvious, however, that with these conflicting conditions, an unrestricted choice of the diameter of the card is not possible, and experience has shown that the requisite combination of attributes is obtained in the most advantageous manner in a card of about 10 inches diameter, and hence we find that the majority of compasses used in the Merchant Marine have dry cards of the Lord Kelvin pattern of about this diameter. A card of this description would obviously be too bulky for aeroplane work.

When, however, the diameter of the card is much reduced, the steadiness is so much impaired that the other system mentioned above, *i.e.*, the liquid system, must be resorted to. In this type of compass the card is immersed in a chamber filled with colourless liquid, and by a special arrangement of air-filled dome, round which the card is assembled, the pivot is relieved of the principal weight of the card by flotation effects.

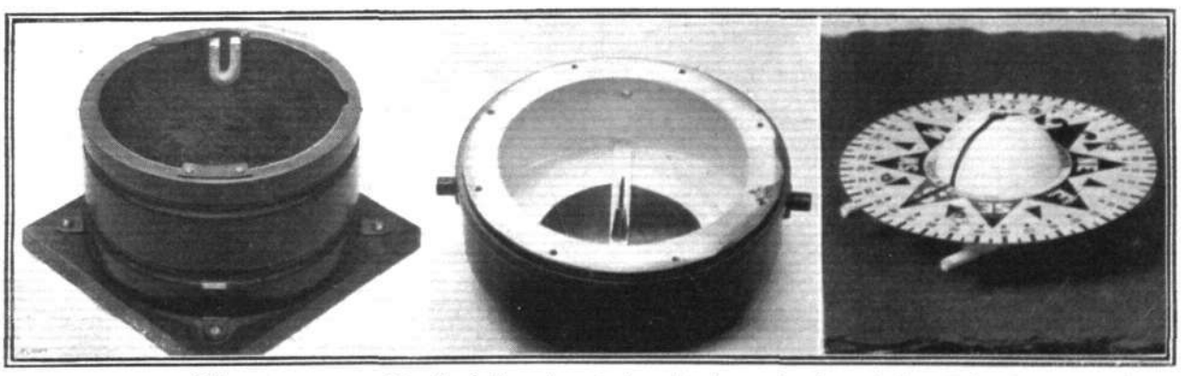
Capt. the Hon. Wentworth Chetwynd, R.N., has devoted an immense amount of attention to the elaboration of compasses of this description, and has shown that they are more suitable to withstand the shock of gunfire and the drastic treatment to which they must be subjected in warships, than are the dry card compasses, with the result that they are now universally adopted by the British Admiralty and the majority of foreign admiralties.

In this connection, and more especially, perhaps, in relation to aero-compasses, acknowledgment is due to Capt. Creagh-Osborne, R.N., who has carried out a large amount of pioneer experimental work.

The well-known firm of Kelvin and James White, Ltd., of Glasgow and London, are makers of the liquid compasses embodying Capt. Chetwynd's improvements, and this firm has now turned its attention to the manufacture of these compasses for aeroplane work.

The cards are supported on pivots tipped with "Osmiridium," a hard native alloy, which is ground and polished to a fine point, thereby reducing the friction between the pointer and the sapphire jewel mounted on the card to a minimum. The card is housed in a light spinning, which, as previously stated, is filled with a colourless liquid. To allow for the varying volume of the fluid due to changes of temperature, the bottom of the bowl is made of an elastic metal diaphragm, which can yield with the expansion or contraction of the liquid.

One of the fundamental improvements introduced by Capt. Chetwynd is the use of a card of small diameter in relation to that of the containing bowl, the object being that the edge of the card is a considerable distance away from any portion of the surrounding containing case. It is well known that when a bowl filled with a viscous fluid is suddenly rotated, the liquid in the immediate vicinity of the walls of the bowl rotates with it, while that in the centre lags behind, and will only be set in motion if the rotation be continued for a considerable time in the same direction. If now the compass card approach the edge of the bowl with any sudden turning motion, the ring of liquid, dragged round by the walls of the bowl, will drag the card with it, and thus will set up a swinging motion of the card and consequent unsteadiness with each turning movement of the aeroplane. The object then of the small card is to remove the edges of the same from all possibility of being acted upon by that portion of the liquid which is carried round by the bow



The outer case, with shock-damping device, the inner bowl, and the card.

when sudden turning motions are effected. This principle, clearly appreciated by Capt. Chetwynd and provided for in his liquid compasses, is one of the causes for their remarkable steadiness. By this means it is possible to obtain a remarkably *steady small card*, and one which, nevertheless, shows remarkably little pivot friction, in fact, all the attributes originally aimed at in the design of the original 10-inch dry nautical card are attainable.

It might also be pointed out here that the well-known difficulty of

picking up a bearing, owing to the similarity of the dividing, is overcome in the Chetwynd card, which is so arranged as to render this an extremely easy matter.

The compass bowl is supported by an antivibrational arrangement in a light metal case, which is provided with a cover to protect the compass when not in use. The space between the bowl and case is packed with horsehair, which absorbs all shock in the event of the machine making a bad landing, and prevents damage to the iridium point.

The outer case is provided with a circumferential groove for purposes of attaching it to the aeroplane. A girdle of stranded wire is wound into the groove, and from this three ligaments of stranded wire, 120° apart, attach the containing case to suitable portions of the aeroplane. The springiness of this ligament attachment amplifies the effect of the horsehair packing as a shock-absorber.

The accompanying illustrations show the complete compass screwed to a wood base ready for shipment (this wood base is usually removed before fitting to the aeroplane), and also the card and inner bowl separately.

However perfect a compass may be in itself, when brought into the neighbourhood of iron or steel, the magnet system is deflected, and does not point true magnetic N. For accurate navigation it is essential that this deviation should be known and corrected, by placing permanent magnets in such positions so as to counteract the disturbance caused by local ironwork, &c. Special magnets in brass cases are supplied with each compass for this purpose.

This adjustment must be done after the compass has been fixed in position in the aeroplane, with the machine under working conditions. It is best carried out by experienced adjusters, with the special apparatus which they use for observing the amount of deviation on the different compass courses.

A word may be said on the necessity for considering the position of the compass when building an aeroplane; a point to which little attention is given. The compass should preferably be set at a convenient height in front of the pilot's seat, with its lubber point coinciding with the midship-line of the machine. It should be put as far as possible from movable iron or steel-work, and, where this is not practicable, phosphor bronze or non-magnetic steel might be substituted for the ordinary steel. This particularly applies to those parts of the steering gear which are constantly having their position changed relatively to the compass, for which no correction can be made.

It is interesting to note that these aero compasses have been adopted by the Admiralty, Royal Flying Corps, Central Flying School, Royal Aircraft Factory, Austrian Military Aviation School, for the airships "Beta," "Clement-Bayard," and by many of the best known pilots. The overall size of the complete compass is $5\frac{7}{8}$ ins. diameter by $3\frac{1}{2}$ ins. deep, and weight, 3 lbs. 2 ozs.

BROOKLANDS FLYING CONTESTS.

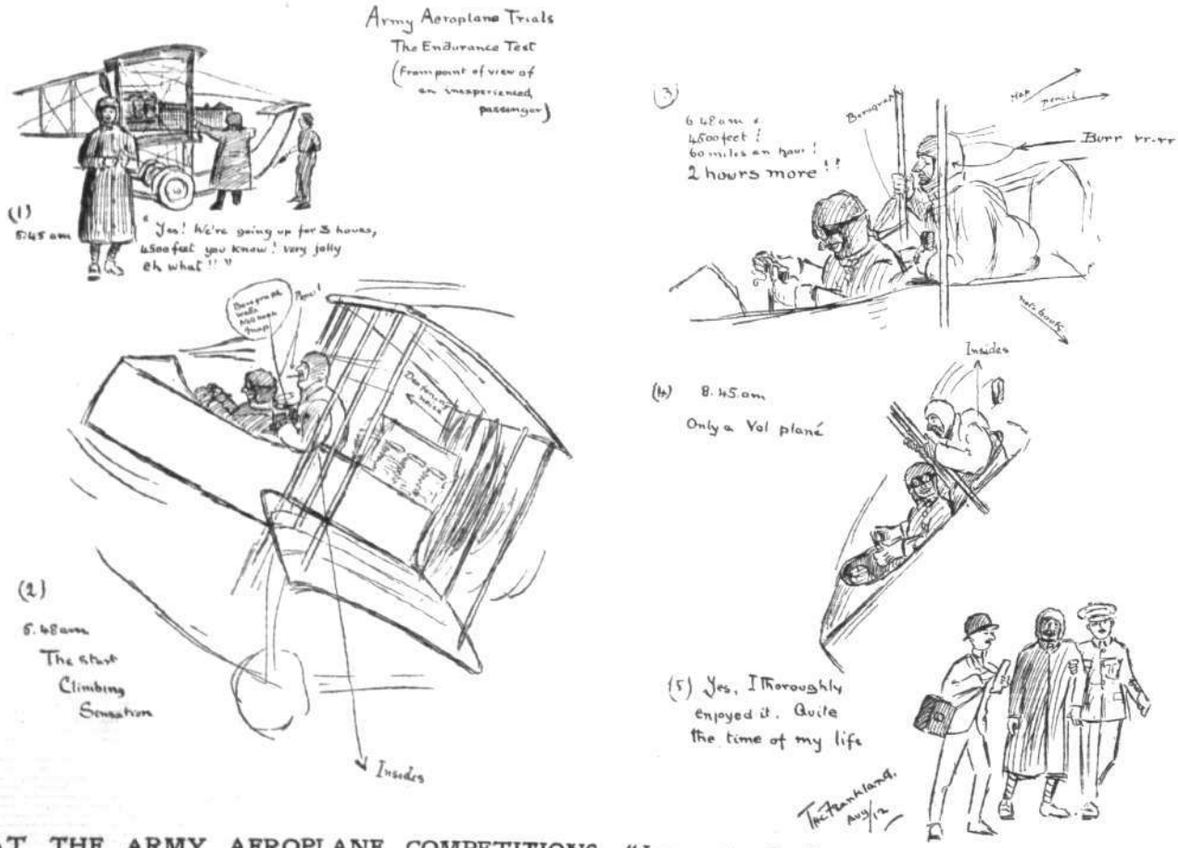
OWING to the high wind last Saturday the cross-country race was abandoned, but Mr. Sabelli on a Hanriot monoplane turned out and gave a first-class demonstration of flying, which was warmly cheered by a large number of spectators. Although the wind was blowing at the rate of 35 miles an hour, he did three circuits of the aerodrome, rising to a height of about 600 ft., and reaching a speed of 100 miles an hour.

Next Saturday there will be a high-flying competition, in which several new machines will be competing.

On Sunday, October 6th, the postponed relay (despatch-carrying) race will be run. The following are the entries: G. Sabelli, 50-h.p. Hanriot monoplane; S. V. Sippe, 50-h.p. Hanriot monoplane; T. O. M. Sopwith, Farman biplane; E. Copland-Perry, Farman biplane; A. Knight, Vickers monoplane; F. W. Merriam, Bristol biplane; Macdonald, Vickers monoplane; Snowdon-Hedley, Farman biplane; H. Spencer, Spencer biplane.

SEVEN TIMES ROUND PARIS IN ONE DAY.

SOME time ago the Seine General Council offered to the Ligue Nationale Aérienne a prize of 5,000 francs for the aviator who, before December 1st, should fly round Paris the greatest number of times in one day, the course stipulated being Juvisy, Vincennes, Le Bourget, Sartrouville-Montesson, Buc and Juvisy, a distance of 100 kiloms. The first serious attempt for the prize was made on Saturday last by Dancourt, flying a Borel monoplane, fitted with a 50-h.p. Gnome equipped with Oleo plugs and Chauvière Integral propeller. He started at 6 a.m. from Juvisy, and made seven rounds, landing at Juvisy for a few minutes each round to sign the control sheet. After the fourth round he had to stop for three-quarters of an hour owing to heavy rain. He landed at the completion of the seventh round, at 6.22 p.m., and was officially credited with 700 kiloms.; but, as a matter of fact, the distance was about 800 kiloms., as he made a *détour* of about 10 kiloms. at Chateaufort each round.



AT THE ARMY AEROPLANE COMPETITIONS.—"Impressions" of an observer on the three hours' test. From a drawing by Capt. Frankland, Royal Dublin Fusiliers.

FLIGHT

METEOROLOGY AND FLYING.

IN the *Scientific American Supplement* some time ago, Mr. W. H. Dines, F.R.S., one of the best-known meteorologists in this country, discussed in a most interesting and readable manner the primary laws of cause and effect as they concern the atmosphere. To the student of other subjects, who is always apt to regard the knowledge obtained in allied sciences as on the verge of perfection, it comes as somewhat of a shock to find that it has never been satisfactorily settled as to whether it is a difference of barometric pressure between two places that creates a wind, or whether it is the wind that gives rise to the difference in the barometer readings. "All that I dare safely assert without fear of contradiction," says Mr. Dines, "is that the heating of the air by the sun's rays, directly and indirectly, is the primary cause of all wind."

Another interesting statement in the same article draws attention to the fact that the wind in question does not blow, as might be expected, from the place of high pressure to the place of low pressure, but has a direction almost at right angles to a line joining the two points. It is the earth's rotation on its axis that causes this effect, and the tendency to change varies as the sine of the latitude of the place. Sooner or later the full amount of alteration in direction occurs everywhere, so long as the initial wind continues. Thus, for example, it may take eight hours for an unopposed east wind to turn into a south wind.

One point on which Mr. Dines is very insistent is in the importance that aviators should attach to the weather charts issued by the Meteorological Office. In drawing a weather chart, places of similar barometric reading are joined together by lines called isobars, parallel to which the wind is supposed to blow. The distance between adjoining isobars gives the barometric gradient when it is divided into the barometric difference. The "gradient wind" is proportional to the barometric gradient, and it has been found from observation that the velocity of the wind at altitudes of from 1,000 to 4,000 ft. agrees very well with the theoretical value obtained from a formula devised by Ferrel, an American meteorologist, for use in connection with barometric gradients as just described. It is the gradient wind that the Meteorological Office calculate in the course of their work, and the information is available to anyone who desires to obtain it. Mr. Dines, therefore, very wisely advises aviators to be guided thereby rather than to make their own estimates of the probable conditions aloft by studying the behaviour of an anemometer or a flag situated only a few feet from the ground.

It is, as Mr. Dines points out, the irregularities in the wind and not the wind itself that constitute a danger to aviators. If the wind were really uniform its effect on flight would merely be one of opposing or facilitating the action of flying in any particular direction. A really uniform wind, which, of course, never exists in nature, would be unnoticed by the pilot in flight, just as a fly in the carriage of a railway train is unconscious that the whole atmosphere of its immediate world is blowing at a velocity of 40 or 50 miles an hour.

From his observations with kites Mr. Dines has found that the effective maximum force of the wind as indicated by the pull on the kite string is approximately the same at all altitudes, but that whereas the force at great heights is due to high velocity, nearer the ground it is due to gustiness. There are various general rules affecting wind that serve very well when making an estimate of the general trend of wind, but on the subject of gustiness there is little or nothing that can be brought to the assistance of the pilot, and the only way to proceed is to practise the art of aviation and learn from the experience of all who fly.

It is interesting to find Mr. Dines disagrees with the idea of increased stability resulting from increased flight speed, and considers that more progress is to be made by flying slowly.

The following are a few of the points which Mr. Dines calls attention to in his article:—

At the earth's surface in England the mean density of the air is such that one cubic foot of it will weigh 1¼ ounces, but owing to changes in the temperature and in the height of the barometer this value may be increased or decreased by some 10 per cent. The mean annual temperature in England is close to 50° F. At a height of one mile the density will be about 82, if we take 100 to represent it at sea level, and the temperature rather over the freezing point. At two miles the density is about 66 and the temperature about 20° F. At five miles, and this is about the limit that man has ever reached, the density has sunk to about 35 and the temperature to a value that will probably be between − 20° and − 60°. Up to five miles there is certain to be a steady decrease of temperature, but somewhere between five miles and nine miles high a point will be reached beyond which the temperatures will cease to fall. The usual height of this point is seven miles, and the usual temperature is from − 50° F. to − 70° F.; but the temperature may be as high as − 40° or at low as − 90° F. At about 15 miles our knowledge from direct observation ceases, but at this point the density is reduced to about 3½ on the scale, and barely one-thirtieth of the whole atmosphere remains above. The temperature is probably about − 60° F.

Some Further Points from Mr. Dines' Paper.

The air is a gas, or rather a mixture of gases together with an indefinite amount of water vapour. The water vapour plays an unknown part in the production of wind, and is responsible for the rain and snow.

In text-books on physics the following distinction is drawn between a gas and a liquid. A liquid when put into a vessel occupies a definite part of that vessel, but no matter how small a quantity of gas is put into a closed vessel, it will expand and occupy the whole of the vessel.

It has been said that a cormorant always has room for just one more fish, and equally there is always room in a closed vessel for just a little more gas, provided the vessel is strong enough to stand the strain, and sufficient force is available to press more in.

If air were of the same density throughout, the atmosphere would reach to a height of above five miles, but as it is there is still some air left at a height approaching 200 miles. This is known from the fact that shooting stars do not become visible until their motion is opposed by the air, and since the height of many shooting stars when first seen is found to be 150 miles or more, we know that there is some air at that height, although it must be extremely rarefied.

As air in the atmosphere comes down from above it is subject to a greater weight of air above it, its pressure is increased, its volume is reduced, and it is warmed. It is a great mistake, but unfortunately even still it is a common one, to think that air from above will be cold because it has come from a cold place.

It is easy to calculate the change of temperature that occurs with a change of altitude, and it happens very conveniently that it is the same for all heights in the atmosphere. For dry air, or at least for air in which clouds are not forming, it is 1° F. for about 200 ft. height; for air in which condensation is occurring it is, under average conditions, at the surface, only half this, namely, 0·5° F. for 200 ft.

Places that are covered by warm air do not always have a lower barometer than places covered by cold air. The rule holds roughly for places in the same latitude, but fails entirely when we compare places in different latitudes.

At sea level in England the barometric pressure may easily vary from 29·00 to 30·50 ins. This is equivalent to a change of 1,500 ft. in altitude.

Almost every wind that blows at an inland station will be found to be stronger at a few hundred feet than at the surface.

As a general rule it will be found that, if you face the surface wind, the wind above will come somewhat from your right hand.

Suppose a balloon is at a height of 2,000 ft. An east wind is not likely to increase much in strength above this height, but a south-west or west wind is likely to do so.

A south-east wind on the surface is fairly certain to turn to a south and then to a south-west wind at a moderate elevation, and a north wind may draw into a north-west, but is not so likely to do so.

As a rule, for winds other than north, a change of two points of the compass in direction and a doubling of the velocity may be expected between the surface and 3,000 ft., excepting during a hot sunny day in spring and summer.

At night, calm mostly prevails in the lower strata, if the sky be clear; and this is particularly the case on frosty nights—and even days, too—in winter.

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

Committee Meeting.

A MEETING of the Committee was held on Tuesday, the 1st inst., when there were present:—Mr. R. W. Wallace, K.C., in the Chair, Mr. Griffith Brewer, Col. J. E. Capper, C.B., R.E., Mr. G. B. Cockburn, Capt. Bertram Dickson, R.F.A., Mr. John Dunville, Col. H. C. L. Holden, C.B., F.R.S., Prof. A. K. Huntington, Mr. F. K. McClean, Mr. J. T. C. Moore-Brabazon, Mr. Alec Ogilvie, Mr. Mervyn O'Gorman, Mr. C. F. Pollock, and the Secretary.

New Members.—The following new members were elected:—Neal Doherty, Lieut. Alan Geoffrey Fox, R.F.C., G. F. Pretyman, Albert Eustace Short, Hugh Oswald Short, and G. W. Young. Total membership to date 1,441.

Aviators' Certificates.—The following aviators' certificates were granted:—

302. Vivian Hewitt (Blériot monoplane, Rhyl).
303. Capt. Charles Erskine Risk, R.M.L.I. (Short biplane, Central Flying School, Upavon).
304. Lieut. Ivon Terence Courtney, R.M.L.I. (Short biplane, Central Flying School, Upavon).
305. Capt. Edward Leonard Ellington, R.H.A. (Farman biplane, Sopwith School, Brooklands).
306. Victor Yates (Blériot monoplane, Fowler's School, Eastbourne).
307. Lieut. Hugh Fanshawe Glanville (West India Regt.), (Bristol biplane, Bristol School, Brooklands).
308. Lieut. Leslie Da Costa Penn-Gaskell (3rd Norfolk Regt.), (Bristol biplane, Bristol School, Brooklands).
309. Capt. Herbert Creagh MacDonnell (The Royal Irish), (Bristol biplane, Bristol School, Brooklands).
310. Arthur Edward Geere (Vickers monoplane, Vickers School, Brooklands).
311. 2nd Lieut. Dermot Roberts Hanlon, R.G.A. (Bristol biplane, Bristol School, Brooklands).
312. Lieut. Felton Vesey Holt (52nd Light Infantry), Bristol School, Brooklands).
313. Capt. George Ralph Miller, R.F.A. (Bristol biplane, Bristol School, Brooklands).

Aeronaut's Certificate.—The following aeronaut's certificate was granted:—

29. E. Fuld. Subject to the sanction of the Aero Club of Germany.

The Late Lord Llangattock.

The following resolution was unanimously passed:—

"The Committee of the Royal Aero Club desires to express its deep sorrow at the death of Lord Llangattock, who had been associated with the club since its foundation, and tenders its sincere sympathy to Lady Llangattock and members of the family."

The Late Mr. H. J. D. Astley.

The following resolution was unanimously passed:—

"The Committee of the Royal Aero Club tenders its deepest sympathy to Lady Florence Willoughby and Mrs. H. J. D. Astley in the loss which they have sustained in the sad accident to Mr. H. J. D. Astley."

Lord Roberts.

The Committee directed that its heartiest congratulations should be sent to Field-Marshal the Right Hon. Earl Roberts, Vice-President of this Club, on the occasion of his eightieth birthday.

British Altitude Record.

The report on the flight made by Mr. G. de Havilland on Salisbury Plain on August 12th, 1912, was considered, and it was unanimously resolved to accept the altitude attained of 10,500 feet as a British Record. Mr. de Havilland made this record on BE 2, designed and manufactured by the Royal Aircraft Factory, fitted with a 70-h.p. Renault motor, and was accompanied by Major F. H. Sykes, Commandant of the Military Wing of the Royal Flying Corps.

Flights to the Public Danger.

The attention of the Committee was drawn to the fact that certain aviators had on various occasions flown at a low altitude over the people assembled in the enclosures at the Hendon Aerodrome, and it was decided to communicate with the proprietors of the Aerodrome on the matter.

International Aero Exhibition, Olympia, 1913.

The Society of Motor Manufacturers and Traders has decided to organise an International Aero Exhibition at Olympia, under the auspices of the Royal Aero Club, in February, 1913. Full details will appear later.

Kite and Model Aeroplane Association.

The Committee of the Royal Aero Club has appointed the Kite and Model Aeroplane Association the authority to govern models in this country for the year 1913.

British Empire Michelin Cup No. 1.

(Under the Competition Rules of the Royal Aero Club.)

The winner of the prize of £500 for the year 1912 shall be the competitor who, on or before October 31st, 1912, shall have remained the longest time in the air on an aeroplane in one flight without touching the ground. The flights may only be made between the hours of sunrise and one hour after sunset, and in order to qualify for the prize the competitor must make a continuous flight of at least five hours.

The entrant, who must be the person operating the machine, must be a British subject, flying on a British-made aeroplane, must hold an Aviator's Certificate, and must be duly entered on the Competitor's Register of the Royal Aero Club.

Rules and entry forms can be had on application to the Club.

British Empire Michelin Cup No. 2, £600.

(Under the Competition Rules of the Royal Aero Club.)

The contest for the current year consists of a cross-country circuit of about 186 miles. Competitors may choose their own course, which must be previously approved by the Club. The competition closes on Tuesday, October 15th, 1912.

The following courses may be used for this competition:—

Brooklands.	Laffans Plain.	Hendon.	Shoreham.
Larkhill.	Newhaven.	Brooklands.	Oxford.
Newhaven.	Larkhill.	Eastchurch.	Larkhill.
Brooklands.	Upavon.	Cambridge.	Shoreham.
	Laffans Plain.	Hendon.	

166, Piccadilly. HAROLD E. PERRIN, Secretary.

ROYAL FLYING CORPS.

THE following announcement appeared in the *London Gazette* of September 28th:—

Royal Marine Light Infantry.—Capt. Eugene Louis Gerrard is granted the temporary rank of Major while holding the appointment of Squadron Commander in the Royal Flying Corps. Dated April 1st, 1912.

Germany Testing Bullet Proof Planes.

EXPERIMENTS are being made in Germany with the object of finding a material for covering planes which will suffer as little as possible from rifle fire. Some tests have been made with planes in which a layer of wire gauze has been placed between the layers of fabric, but the weight of this arrangement is a serious disadvantage. Another idea is to abandon the use of fabric and to utilize a very fine wire gauze in which the interstices are filled with varnish, a system, no doubt it will be remembered, advocated in FLIGHT some years ago by Mr. Crosland Taylor.

Honours After French Manœuvres.

THE names of Capt. Neant, Lieuts. Vigne, de Montjou Noe, Massol, Pierra, Nicaud and Schlumberger, all well-known French pilot-aviators, have been put forward for the Legion of Honour, while Sergt.-Major Guyon, Sergts. Perretti, de Seyssels, Beauvens and Adjutants Allemand, Combrond and Girard have been awarded the military medal.

More Bleriots for French Army.

A COMMISSION of French military officers, under Capt. Destouches, visited Etampes on the 25th ult. to witness the tests with a number of Blériot machines built for the French Army. They comprised both the single-seater and tandem types of machines, and all easily passed the stipulated tests at the hands of Perreyon.

And Some More Borels.

CAPT. DESTOUCHES, on the 26th ult., was at Buc, and witnessed tests with one single-seated and a couple of two-seated Borel monoplanes for the army. Chambenois and Chemet went up on the two-seaters, 500 metres in 5 mins.

FROM THE BRITISH FLYING GROUNDS.

Brighton-Shoreham Aerodrome.

Avro School.—Owing to awful weather little flying has been done during past week. Wednesday H. Simm put up half-hour flight well out of aerodrome at a good height, testing ground for *remous*, and found wind much too high for pupils.

Simm testing air Thursday, did half a dozen circuits, then handed machine over to pupils S. Gaskell and P. Home for rolling. Weather remainder of week too bad for air work. Tuesday last wind and rain all day till evening. Simm then did a circuit, and came down wondering what was the matter, as the machine was lifting badly. But it was only the awful weather that was to blame.

Collyer-England School. — Wednesday last week G. N. Humphrey put in four circuits, doing exceptionally well on 40-h.p. Green-engined Collyer-England, and he appeared to be quite ready for his *brevet*. Then handing machine over to Newton Smith, who did one circuit as a finish before dark.

Newton Smith Tuesday last in the Collyer-England biplane, in bad weather, was fighting against a strong disinclination of the air to lift his machine. He steered away a bit too far before having felt the quality of the air. Rising for a circuit he was out of the aerodrome at once over the ploughed land, and striking a *remous*, he managed to finish his little trip with a very successful pancake, resulting in one broken strut and slight other damage.

Brooklands Aerodrome.

EARLY Monday, last week, Mr. Sippe was on the Hanriot monoplane, whilst Mr. Ducrocq was flying the Farman with the new Rossel-Peugeot 50-h.p. engine, which is giving good results. Mr. Merriam was on the Bristol, also very early, but found it too bumpy for school work. In the evening he found it improved a little, therefore sent Capts. MacDonnell and Miller, Lieuts. Hanlon and Hope, and Mr. Payze all on straight lines. Mr. Merriam then took up in front Lieut. Loultcheff for couple of straights. Mr. Bendall finishing the evening work flying to the hangars. At the Spencer school Mr. Spencer giving tuition to Mr. Hitchcock and other pupils. On Tuesday, Messrs. Sippe and Sabelli out at 6.30 on Hanriot, and Mr. Ducrocq ascended on the Farman, flying for one hour to test the engine, which ran very well. Messrs. Merriam and Bendall, of the Bristol school, were trying conditions on two separate machines, then both up with pupils for tuition. Capt. Miller, Lieuts. Hanlon, Hope, and Mr. Payze were flying solos, whilst Capt. Gibbon was doing straights. Lieut. Loultcheff and Mr. Payze, all doing straights, being too gusty for circuits. Mr. Bendall up with Lieut. Ali, Mr. Merriam afterwards giving tuition to same pupil in front seat. In the evening Mr. Raynham on the Howard-Flanders monoplane started away for Hendon in rather a bad wind, making two circuits over the aerodrome and reaching an altitude of over 1,000 ft. Mr. Merriam soon after tried conditions, but found none too good for school work.

The Bristols were out Friday morning with many pupils, and making good use of a fine morning by another pupil taking his certificate, namely, Capt. Miller. This makes the ninth certificate that the Bristol School have passed within the last three weeks, which speaks well for the quick and thorough tuition received through Mr. Merriam and Mr. Bendall, his able assistant. The Martin-Handasyde with the Antoinette engine was doing straights under the pilotage of "Petre the Painter." At the Hanriot School Mr. Sippe was carrying out many effective evolutions, finally landing with a clever spiral descent. Mr. Ducrocq ascended on the Farman, flying excellently, as usual. Mr. Sabelli went off in the direction of Hendon, but had to come back owing to fog.

"Petre the Painter" again doing straights, Saturday morning, on the Martin-Handasyde monoplane, and seemed to be flying very well indeed. Mr. Merriam took up for his first trip a new pupil, Capt. Pigot, but found the air too bad for pupils to fly alone. Saturday afternoon there were crowds of spectators to see the "cross-country race," but unfortunately the weather conditions for flying were not good enough, the only one to venture out being Mr. Sabelli, on the Hanriot, who gave a really attractive exhibition, finishing up with a neat *vol plané* over sheds and people.

Vickers School.—Knight was out early Wednesday last week with Capt. Stott on the Farman for instruction and then took No. 2 for a couple of straights before handing the machine over to Lieut. Joubert de la Ferte, who has just joined the school, who put in some useful practice. On Thursday, Knight on the Farman early taking up pupils, and Capt. Wood also out for several circuits. Knight and Barnwell both up on No. 5 for about quarter of an hour each. Later in the morning MacDonald brought out No. 6 machine and flew a couple of circuits in his usual style. Lieut. Joubert de la Ferte on No. 5 was unlucky enough to turn her over on her nose while taxying, fortunately with no greater damage than a broken propeller. Next day Lieut. Joubert de la Ferte was doing straight lines on No. 2 handling the machine quite well. He will evidently have no difficulty in picking up the monoplane.

Saturday, Knight was on the Farman with passengers and then took No. 5 for a couple of circuits before handing it over to Barnwell who put in some good flying in a puffy wind.

Monday, Capt. Stott on No. 2 was showing decided improvement. MacDonald was also out for a short time on No. 6. Capt. Stott again out Tuesday on No. 2 flying straight lines very steadily and showing considerable improvement.

Farnborough (R.F.C.)

ONE of the most active flyers during the past week has been Lieut. Longcroft. On Wednesday he was up on Biplane 204 for 45 mins., Thursday he went over to Borden to visit his old regiment, Friday he took Lieut. James to Chatham and returned with him on Saturday. Verrier arrived on Thursday week from Hendon on a new Maurice Farman, while during the past few days Mr. de Havilland has been busy testing some of the latest BE 2 machines, and a new 70-h.p. Breguet has been tuned-up by Montalent. Good flying has also been done by Majors Burke, Brooke-Popham and Moss, Capt. Darbyshire and Lieut. James.

Liverpool Aviation School, Waterloo (near Liverpool).

WEDNESDAY, last week, Melly took out the two-seater, but one cylinder was missing so badly that no attempt was made to go up. On Monday, Hardman took out the "V"-engined machine in perfect weather, and after one flight up and down the beach did his *brevet* test, unfortunately in the absence of official observation. His turns and banking were exceedingly well made, and he finished the circuit switching off at a height of 80 ft.

London Aerodrome, Collindale Avenue, Hendon.

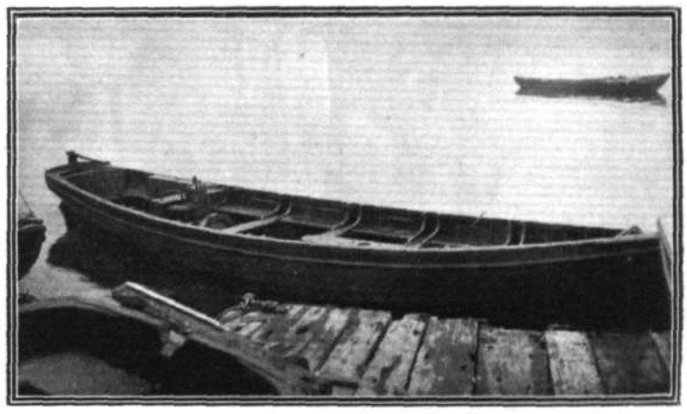
Grahame-White School.—Monday last week school out at 6.30 a.m. under instruction of Mr. Noel. Major Maddocks and Mr. Clarke rolling, Messrs. Wilson and Fuller straight flights on No. 7 biplane. In the evening Capt. Kunhardt, Lieut. Allen and Mr. Wilson straights on No. 7, and Mr. Hoelscher circuits on same machine.

Capt. Kunhardt and Mr. Wilson got in half-an-hour's good practice at straight flights Tuesday evening.

School opened at 6 a.m. Wednesday. Capt. Halahan, Messrs. Wilson and Clark, Capt. Kunhardt and Mr. Hoelscher out in order named, making good straight flights on No. 7 biplane under Instructor Noel. Then Mr. Roupell doing straights on B 2 monoplane. Mr. Fowler in same machine, first rolling, afterwards making good straight flights. Messrs. Wilson and Lieut. Allen finished the morning's school work putting in good straights on No. 7 biplane under the instruction of Mr. Blackburn.

Thursday, at 6 a.m., in calm weather, Mr. Wilson, Lieut. Small, Major Maddocks, Messrs. Clark and Hoelscher, and Capt. Kunhardt all making straights on No. 7 biplane. Next morning straights on same by Messrs. Wilson, Clark, Wynne, Fuller, Capt. Kunhardt, Major Maddocks, and Lieut. Small.

At 3.45 p.m. Sunday, Mr. Lewis Turner gave a fine exhibition on Grahame-White biplane in a 25–30 m.p.h. wind. Mr. Noel, 5.15, on Henry Farman 80-h.p. biplane for 10 mins. flight. Mr.



An old 23-ft. ship's boat was a little time ago installed with a slow-running two-stroke motor by Messrs. W. White and Co., of Fulham, for Messrs. Short Brothers, of Eastchurch, Sheppey, to be used in connection with the hydro-aeroplane trials which are taking place on the river Swale, Whitstable Bay. This boat, which was selected by Messrs. Markham and Prance, the consulting engineers of Southampton Street, was delivered under its own power from Chatham to Harty Ferry.

Turner out again immediately after with a 15 mins. flight, and Mr. Desoutter at 5.40 on 50-h.p. Blériot with circuits.

Blackburn School.—Monday, last week, Messrs. Buss, Christie, Glew and Spink all out at 6.30 a.m. doing rolling practice until 8.15. Again repeating practice from 5.50 until 6.30 evening. Next day, Spink, Glew, Buss out at 5.50 a.m., doing straights and handling the machines well. Spink, Buss and Glew out practising rolling at 8 a.m., Wednesday, making perfect straights at full speed. Pupils at work early Thursday until 7.45, Buss and Spink each making short flights for first time and landing without mishap. Dr. Christie, Spink, Buss all rolling at 5.40 a.m. Sunday, in high wind. Two machines more or less about until midday, sustaining some pretty severe bumps on rough ground without any damage.

Blériot School.—M. Gratien was one of the first out Monday morning last week, taking LB 1 across and back several times, getting the tail nicely up once or twice. He had trouble with engine misfiring at times. Mr. Reilley also had the same machine out rolling. A lot of work was done in the evening, the wind dropping early. Messrs. Webburn and Clappen were doing straights on LB 2, and Messrs. Reilly and Gratien rolling on the taxi. Tuelade had the *brevet* machine out, but contented himself with doing one straight flight across and back, owing to a combination of excessive lubrication and gathering darkness. He should be the next pupil at the school to go for his *brevet*.

No practice was advisable during Tuesday, early morning, owing to high wind, but in the evening Messrs. Gandillon and Gratien were able to indulge in a little work, the former doing a straight on LB 2 while M. Gratien rolled across and back twice in the taxi.

Wind made Wednesday blank for school work, but Messrs. Gandillon and Gratien were out Thursday morning doing a little work before the wind rose. M. Gandillon accomplished a trio of straights on LB 2, whilst M. Gratien was responsible for a similar number of rolls on LB 1.

M. Gratien was out early Friday on the school taxi, but was unable to do much owing to a loose connection inside coil, which necessitated the machine being returned to the sheds. Next day no school work was possible owing to high wind. Mr. Hamel was putting in some more of his wonderful aerial performances in the afternoon notwithstanding, first on his own machine and afterwards testing Mr. Hall's machine.

British Deperdussin School.—No school work Wednesday last week, weather too windy. Thursday morning, Mr. Phelps, Capt. Mapplebeck and Mr. Whitehouse all putting in good rolling practice on taxi No. 1. Mr. Ware and Lieut. Tucker doing straight flights on Dep. No. 4, making excellent progress. Mr. Brock also circuits on same machine. In the evening Mr. Brock went up to test weather, but found it too windy for pupils.

Mr. Phelps and Lieut. Brock rolling on taxi No. 1 on Friday morning. Mr. Spratt and Lieut. Tucker some useful straight flights on Dep. No. 4. Mr. Brock doing circuits on Dep. No. 4.

Saturday, Lieut. Brock and Mr. Phelps putting in good practice rolling on Dep. No. 4.

W. H. Ewen School.—During the past week the weather has not been very propitious but the pupils at the school have, notwithstanding, been able to get in four very good days' practice.

On Monday, after a test flight by Mr. Sydney Pickles, Mr. J. H. James flew two circuits on the 35 Caudron, keeping the machine absolutely in the air and making a nice landing. Later the same pupil made a splendid flight of several circuits at an altitude of 200 ft. Mr. Pickles then took Mr. Lyley for a passenger flight of three circuits on the 35 Caudron, and immediately after started out for a cross-country flight over Elstree and Barnet. In the air for 45 minutes, he reached an altitude of 3,000 ft. and by the time he had returned to the aerodrome a stiff breeze had sprung up. In the meantime M. Baumann was busy with pupils on monoplanes Nos. 1 and 2. Capt. Chamier and Lieut. Eric Conran were showing excellent progress in straights and half circuits at 50 ft.

In the evening the pupils were again out and Lieut. Eric Conran was putting in some excellent flying on monoplane No. 1, with Mr. L. Russell doing hops and straights on the same machine. After a test flight Mr. Pickles handed the 35 Caudron over to Messrs. Apcar and J. H. James who each got in several good flights before dark.

Tuesday morning was a blank on account of the weather, but in the evening M. Baumann had Lieut. Eric Conran on monoplane No. 1 making excellent progress. Wednesday was also a blank day as far as pupils were concerned, the wind not dropping the whole day. In the morning Mr. Sydney Pickles was on the 35 Caudron and also made two magnificent trips on the 60 two-seater. In his second flight he circled the surrounding country at 2,000 ft. landing from this height with a very fine long glide. In the evening he was again on the 60 putting up a fine exhibition notwithstanding a strong wind.

A good amount of school work was got in on Thursday. Lieut. Eric Conran was making nice flights and fine landings from 30 ft. on No. 1 monoplane, while Mr. H. James was doing some good flying on No. 2 monoplane. Mr. Pickles, after a test flight on the 35 Caudron, handed the machine over to Capt. Chamier who made four good flights in quite a confident manner. Mr. Pickles then took the 60 two-seater Caudron, and rising quickly to 5,000 ft. made a flight of 35 mins., finishing with a beautifully judged *vol plané*.

The pupils were out at 6 a.m. again on Friday, Mr. Pickles instructing on the 35 Caudron. M. Baumann had Lieut. Eric Conran, getting in some excellent work with No. 1 monoplane, to himself. Capt. Chamier and Mr. H. James each made several good flights on monoplane No. 2 and added considerably to their experience by putting in some good flights at 40 ft. in a rising wind. When the school work finished, Mr. Pickles was up on the 60 two-seater for an exhibition, after which he took up Mr. J. H. James for a passenger flight on the same machine.

With a 30-mile wind blowing, school work was impossible on Saturday morning, so Mr. Pickles started off on the 60 two-seater Caudron biplane and made a fine flight to Farnborough.

Sunday was a blank day for flying practice but the pupils were assisting in the hangars assembling the 45-h.p. two-seater Caudron which had arrived the previous day.

Salisbury Plain.

Bristol School.—On Monday last week, there was no flying all day owing to bad weather.

Tuesday the wind was too strong for school work in the morning, but in the afternoon Jullerot was out at 4 for a trial in the Bristol side-by-side monoplane, afterwards giving tuition to Mr. Lywood on the same machine. Jullerot was out again on biplane, taking up Lieuts. Sabri, Fezel, Aziz, and Sofet. Pizey then went out with Mr. Penfold on side-by-side with Prince Cantacuzene, Lieuts. Hall, and Fezel. Afterwards, Mr. Arthur took out Messrs. Lucina, Parker, and Lywood.

There was no flying on Wednesday morning, but Harrison was first up in the evening taking Messrs. Lywood, England, Penfold, and Lieut. Fethe. Then in one of the two-seater Bristol monoplanes gave a flight to a prospective pupil. Pizey then on side-by-side monoplane gave two tuition flights to Prince Cantacuzene, Lieuts. Hall, Aziz and Lucina and then out in biplane with Lieuts. Aziz and Parker. Jullerot gave flights to Lieut. Fezel reaching 1,200 ft. on monoplane, then taking Lieuts. Fezel, Sabri, Fethe on biplane. Busteed went for a solo on a monoplane and Geoffrey England gave tuition flights to Mr. Lucina in biplane and Lieut. Sofvet in side-by-side monoplane.

On Thursday no flying was possible till the afternoon when Pizey took Lieut. Fethe in one of the Bristol monoplanes, Jullerot ascending with Lieut. Aziz in a monoplane. Busteed was out for a solo but the rising wind prevented further work.

A gale was blowing on Friday all day completely stopping all flying.

On Saturday no improvement was found in the previous day's weather and no flying was attempted.

Royal Flying Corps.—Early last week a good many officers and men returned from manœuvres, and the rest of the week was spent overhauling machines. On Monday some Maurice Farmans were out, Lieut. Ashton taking Lieut. Connor over to the C.F.S. at Upavon, while Lieuts. Longmore and Cholmondeley came in from Upavon. Owing to the severe weather the corps is returning to Bulford Barracks for the winter months.

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Post Impressions of a First Mid-air Trip.

A DAY or so ago, Messrs. Midwinter and Feary, of Aeros, Ltd., were down at Brooklands on business when Mr. Sopwith, wishing to make an experimental flight on his 50-h.p. Gnome-Farman, called for passengers. Mr. Midwinter, who had not previously been up, at once volunteered and together with another passenger took his place beside Mr. Sopwith on the leading edge of the main plane, arrangements being made to pick up Mr. Feary at the other end of the field. This was accomplished easily, the machine running in splendid style in spite of its heavy load of four persons. Mr. Midwinter so enjoyed his trip that he had to go up again, this time with Lieut. Marks, and when near the sewage farm a *remous* let the machine down 50 ft., the only impression on the passenger's mind being (where ignorance is bliss, &c.) that it was like an extra fine switch-back. While returning to town in a motor car Mr. Midwinter gave expression to his feelings. "It doesn't seem right," said he, "after having tasted the joys of flying to go home and do such a prosaic thing as to retire to a common-place bed. One feels nothing less than to roost on a tree should meet the case."

FLIGHT

MOMENTUM IN AIR.

A LETTER appearing in our Correspondence columns this week so exactly presents a case for the opposite side that it offers a very welcome opportunity to open a discussion on this strangely elusive question, momentum in the air. Our correspondent holds the view that a machine flying against a wind of its own speed possesses the momentum of its relative velocity through the *air*, notwithstanding the fact that it remains stationary in space with regard to the earth. Our own view, as he correctly records, is that it possesses no momentum, and will, therefore, fall headlong if the wind instantly subsides, and the engine is stopped at the same moment. On the other hand, our correspondent argues that the machine, also with the engine suddenly cut off, would instantly rush forward into the calm at a speed equivalent to that of the wind which had suddenly disappeared.

It would be difficult to find two conclusions so diametrically opposed, and yet the holders of both are in good company. It is curious, but this happens to be one of those questions about which a thinker seems able only to see one answer, although it is clear from the fact that the answers are so different that there must equally be something worthy of each other's interest in the different points of view.

Momentum means quantity of motion and there can be no question but that, as a term of definition, it refers to movement relatively to the earth's surface, because in the days of its origin, flying was not even numbered among the possible arts. From this point of view, therefore, there is no other alternative than to say that an object stationary in space relatively to the earth possesses no momentum. If it has no momentum it has no motion, and therefore no power of its *own* to move : under the external force of gravity it will, however, fall, unless supported.

Now, flying is a method of obtaining temporary support in the air, and the laws of flight are such that the phenomenon depends wholly and solely on maintaining relative motion between the object supported and the air by which it is supported. As a principle, it has no concern whatever with motion on the part of the aeroplane relatively to the earth, but since relative motion between two objects cannot take place unless at least one of them moves relatively to the earth, it follows that the laws of momentum do incidentally enter into the problem, either with respect to the aeroplane or with respect to the air, or with respect to both.

Air in motion, as wind, possesses momentum, and in the case at present under discussion—which supposes the aeroplane to be in stationary flight against a wind of its own velocity—the momentum incidental to the situation is located wholly in the air, and such being the case, the wind would not, in fact, cease to blow across a fixed point in space with such hypothetical abruptness as has been assumed for the purposes of the argument.

Perhaps the best way to deal with the case is to assume a few other alternative conditions to the hypothetical sudden calm—as, for instance, that the engine stops while the wind is blowing. If, as our correspondent suggests, the aeroplane possesses the momentum of its relative velocity, then the quantity of motion at its disposal must have been gained while the wind was blowing, and is, therefore, already present—that is to say, it is not something that the machine acquires merely because the wind suddenly ceases. Being present, it is therefore equally available for use whether the wind continues to blow or not, and the latent energy that is to make the machine shoot forward in a sudden calm should equally be serviceable in supporting it for a while against the wind. Yet, in practice, a pilot faced with such a predicament would surely expect to make a very hurried dive.

Again, imagine a machine beating up against the wind and then making a quick turn down wind, is it not accompanied by an appreciable loss of altitude? Or, a machine is flying very fast with the wind and then turns up wind, does it not tend to rise, notably so if it happens to be a "box kite"? The decrease and increase in altitude in the two cases represent a loss and a gain of potential energy (weight by height above the ground) respectively, which can only have been derived from a comparative lack of momentum in the first instance, and a comparative excess of it in the second case. The wind, we may assume, was blowing at a uniform velocity throughout, the machine let us suppose was the same on both occasions, and, therefore, so was its relative velocity through the *air*. The only variable factor is, therefore, the actual velocity relative to the earth, which was very low when flying against the wind and very high when flying with the wind. Under the former conditions, the momentum was evidently inadequate to make the machine accelerate up to the relative velocity required to sustain horizontal flight, because it had to borrow from gravity in order to do so, and it paid its debt by a corresponding loss of potential. In the second case, the momentum was more than sufficient to maintain the relative air speed during the turn, and the surplus energy became transformed into an increase of potential.

It is, by the way, entirely on this idea of momentum that the very pretty theory of soaring flight in a pulsating horizontal wind is established, and the switchback model in which a ball is made to climb from the lower end to the upper by suitable horizontal movements of the switchback itself, affords a useful method of graphically illustrating the principle. Elementary mechanics has a way of becoming elusive when seen through the mysterious glamour of flight, but an aeroplane is, after all, a machine of locomotion first, and only incidentally a flying apparatus when it comes to its relation with the natural laws of force and motion. Being a ponderable object, it possesses potential energy so soon as it rises off the face of the earth, but it does not possess kinetic energy (momentum) unless it is already moving relatively to the earth. Its potential energy is exchangeable for momentum, but the transformation involves the process of descent under the natural force of gravity ; in other words a fall, which in the parlance of aviation becomes, when properly executed, a "dive."

Thus, the dive is a manœuvre that must necessarily be reckoned with in flying because it is the *modus operandi* by which the pilot exchanges some of his potential energy—which he has stored up by climbing to a great altitude—for the kinetic energy (momentum) that he suddenly needs in order to maintain the relative velocity between his machine and the air, which is incidental to the phenomenon of flight. The graphic explanation that it is safer to fly high because "one has more room to fall" thus, in reality, has an equally simple scientific explanation. When the pilot climbs up to an altitude of 1,000 feet or so he is using his surplus engine power to purchase potential energy. True, that energy may dash him to pieces if he loses control, but, ignoring this unhappy aspect of affairs as foreign to the proper purpose of flying, the fact remains that flying high is the most scientific form of insurance against unexpected changes in the immediate conditions.

When the machine possesses actual velocity relative to the earth, it has the energy of its motion (momentum) in addition to the potential energy of its weight. In this case, it may have no need to "cash in" its altitude in order to maintain its flying speed in emergency. Thus, if the engine stops in a calm, horizontal flight will merge into a glide at once, because the momentum of the machine is sufficient to maintain the relative motion, while the pilot switches on the "gravity motor" by changing into a gliding attidude. It is merely exchanging one sort of engine for another, and at the end of the glide the machine still possesses the momentum with which it started, but has expended all its potential in the maintenance of gliding flight.

There remains, therefore, the problem of how to avoid the evil side of the kinetic energy still remaining, and the manœuvre of "flattening out" is, scientifically, the process of exchanging this momentum for potential. If the potential is represented by only a foot or so of altitude, as is the case in a well-judged landing, the machine has no distance to fall when it loses flying speed, but if the flattening out has been miscalculated in that it has taken place too high from the ground, it is either a case of "pancaking" or of re-starting the engine and making another attempt.

Obviously, it is because of the difference between the momentum in the two cases that landings are preferably made up wind—under suitable conditions, a machine might alight vertically, like a parachute, against a wind of its own speed.

The question of momentum in air is one well worthy of study, particularly so because a full comprehension of the subject is evidently essential to a pilot's understanding of what is taking place in the air. For our own part we shall welcome discussion on the subject in FLIGHT, for it is eminently a problem related to the field of simple applied mechanics, by which we put so much store as the proper foundation for the study of aerodynamics. Moreover, as there appears to be a wide difference of opinion on the matter, it would be just as well to have it thrashed out now as later.

The Tragic Death of Chas. Voisin.

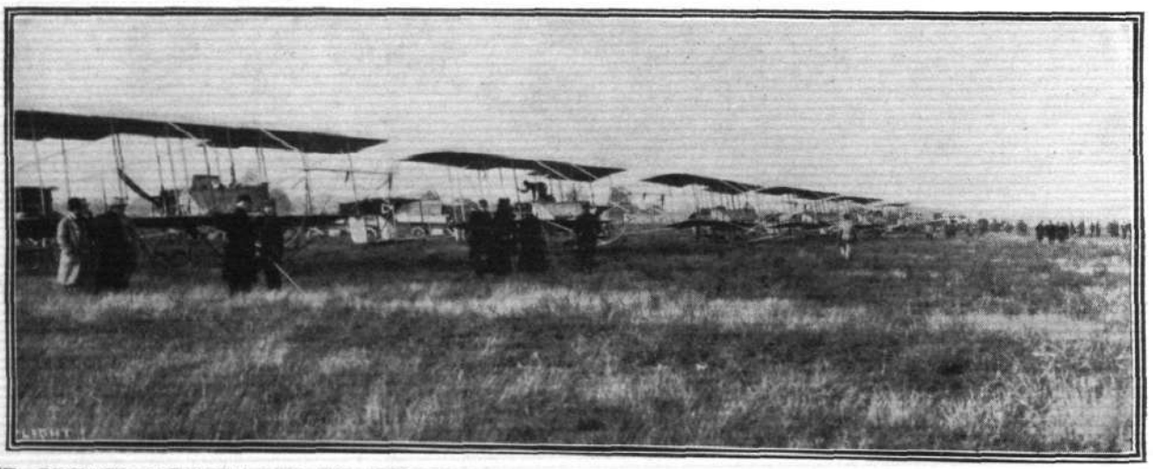
BY the fatal motor car accident which overtook Charles Voisin, one of the Voisin Frères, the world has lost another pioneer. He was the business man of the famous firm, his brother Gabriel devoting himself to the designing and construction side ; but Charles Voisin left the firm something over a year ago, and for some months he managed a tour with Audemars, Barrier and Garros in America.

He was returning from St. Etienne, and when at Belleville-sur-Saone, near Macon, the car he was driving was overturned through collision with another motor car. Charles Voisin was pinned beneath the car, and on it being raised it became evident that he had been instantly killed. Madame de Laroche, the aviatress, who was also in the car, was thrown clear of the wreck, but was severely injured.

THE FRENCH ARMY AEROPLANE REVIEW.

The Deperdussin monoplane escadrille at the great French aeroplane review at Villacoublay last week.

AN extraordinary sight was witnessed at Versailles on Friday, of last week, when a review of aeroplanes which had taken part in the Grand Manœuvres was held. Seventy-two machines, practically all of which have been flown over from their various stations by their pilots, were drawn up in "escadrilles" for inspection by M. Millerand, the Minister of War. They comprised all types, including Blériot, Deperdussin, Hanriot, Morane, R.E.P., Sommer, Nieuport, and Borel monoplanes, and H. Farman, M. Farman, Breguet and Caudron biplanes, with the monoplanes in a very large majority. M. Millerand arrived on the ground at 6.30 a.m., accompanied by Colonel Hirschauer and General Chevalier, and at once commenced to closely examine the various machines and their equipment. Each escadrille was drawn up in line, with the pilots in front and the motor workshops, &c., behind. The first to be inspected was a Maurice Farman escadrille, followed by one served by H. Farman machines, then one using Blériots, then one with Deperdussin monoplanes, and so on. At the conclusion of the inspection the pilots were summoned to the centre of the ground and congratulated by M. Millerand on the splendid work done at the manœuvres and elsewhere. The ceremony lasted about an hour and ten minutes. After the departure of the War Minister the machines began rising in the air to fly back to their various stations. The first away were three R.E.P. machines to Buc, then a Blériot escadrille in company set off for Etampes, several Hanriot machines for Rheims, some Deperdussins to Rennes, a couple of Sommer monoplanes to Mourmelon, and several Farmans to Meaux. The departures continued throughout the morning and afternoon, and by the evening the Versailles ground wore its customary aspect. Among the spectators at the review was the Grand Duchess of Mecklenburg-Schwerin.



THE GREAT FRENCH AEROPLANE REVIEW AT VILLACOUBLAY LAST WEEK.—General view of the Maurice Farman escadrille.

Five-Hour Voyage by "Z.3."

HAVING concluded the series of bomb-dropping experiments at Gotha the Zeppelin military dirigible left on the 26th ult. for Metz. She reached her destination safely, having taken five hours for the voyage of 400 kiloms.

To India by Aeroplane.

SOME progress has been made with the scheme for an aeroplane race from London to India. It is announced that several Indian princes have actively interested themselves in the proposal, and that the Maharajahs of Jodhpor and Bikanir and the Begum of Bhopal have promised £666 between them towards the prize fund. The route proposed is from London to Calais, then to Brussels, Cologne, along the Rhine to Frankfort, Ratisbon, along the Danube, Constantinople, Konieh, Cilicia, Adana, Alexandretta, Meskene, along the Euphrates to Bagdad, along the Tigris to Basra, across the Persian Gulf to Bushire, and then down the Indian coast to Karachi. The distance of the proposed route is 4,800 miles and it is suggested it could be covered in twelve daily stages of 400 miles.

FLIGHT

FOREIGN AVIATION NEWS.

Cross-Channel Hydro-Aeroplane Service.

NEGOTIATIONS are still going on with regard to the proposal to establish a cross-channel aeroplane service, and at the last meeting of the Folkestone Town Council a request was received from the Compagnie Generale Transaerienne for permission to erect a shed on the sea front at Folkestone. It was stated that the authorities at Boulogne and Calais had afforded similar facilities. It was decided to refer the matter to the agent of the Earl of Radnor who owns the foreshore.

Issy to Calais in Three Hours.

ON the 25th, Guillaux on his Clement-Bayard monoplane made a non-stop flight from Issy to Sangatte, near Calais, taking three hours for the trip.

Two-Hour Trip on a Caudron.

RENE CAUDRON on his biplane left Amiens on the 25th ult., and flew over to Issy in a couple of hours. Later he continued his journey to Villacoublay.

Good Flights on R.E.P. Machines.

ON the 26th ult., at Buc, Granel, on a 90-h.p. R.E.P. two-seater, was up for an hour, flying over Versailles and the neighbourhood. Lieuts. Precardin and Bruguiere each made trials of an hour's duration over the aerodrome. Brigadier Vallet made a two-hour flight on Saturday.

A Train Superior Pilot.

LIEUT. LEVASSOR passed one of the tests for a superior *brevet* on the 25th ult., flying over a course from Chalons to Juvisy and back on his Train monoplane.

Good Work at Farman School at Buc.

AT the Farman School at Buc, on the 26th ult., Guy d'Autroche in the morning paid a visit to Etampes, and in the evening made one test for his superior *brevet*, flying for over an hour at a height of 2,000 metres; d'Abrantes rounded off his tuition with a flight of an hour's duration. Another pupil, Lieut. Godot, made a similar flight on the following day, when Renaux was testing a machine which will be used by the Italian Army in Tripoli. On Saturday, Bernard was testing another Maurice Farman for the Italian Army, and with a load of 400 kilogs. flew for an hour at a height of 500 metres. He was also testing a new Maurice Farman for the British Army. Lieut. Massonaud put up an hour's flight at a height of 400 metres.

A Chilian Flyer Doing Well.

AT the Blériot School at Etampes, on Saturday, the Chilian, Capt. Avalos, made a flight of an hour at a height of 950 metres, the trial being witnessed by Col. Dartnell, of the Chilian Legation. On the previous day he flew from Etampes to Orleans and back.

Fine Progress by Servian Officers at Blériot School.

THERE are a large number of pupils from the several Balkan States at the Blériot School at Etampes, and a good many of them are giving good promise of becoming fine flyers. On Saturday, the Servian Lieutenant Miloch Ilitch completed his period of training by a flight of an hour, and a similar flight was made by a fellow officer, Iboine Stankowitch, on the previous day.

St. Cyr to Chartres in 45 Minutes.

ON the 27th, Debroutelle with a pupil, Roques, flew from St. Cyr to Chartres on a Zodiac biplane, doing the trip in 45 mins. at an altitude of a thousand metres.

A Lecture Tour for Vedrines.

SEVERAL days after the opening of the French Aero Show Vedrines intends to start on a tour of France, flying in stages of between 250 and 300 kiloms. in giving lectures in the more important towns. His idea is to start from Paris and fly to Dunkerque, and follow the coast of France *via* Brest, Bordeaux and Biarritz, then across to the Mediterranean, along the coast to Mentone, and back to Paris *via* Belfort.

Long Flight on Henry Farman Machine.

ON Saturday Lieut. Remy made a splendid flight from Mourmelon to Sissonne Camp, and then on to Mailly Camp and back to Mourmelon, a distance of about 220 kiloms. There was a very strong and bitterly cold wind blowing but the pilot kept at an average height of about 1,200 metres.

For the Coupe Pommery.

ON the 24th ult., Marcel Cavelier left Calais on a 50-h.p. Deperdussin-Gnome in an attempt on the Coupe Pommery. He made a first stop at Amiens, and a second at Sens, but had to abandon the attempt at Juvisy. During the 400 kiloms. the wind and fog had made it very difficult to him to find his way, and a greater part of the distance he had to rely entirely on his Monodep compass.

A French Officer Killed.

ON September 24th Lieut. Thomas died in the hospital at Bar le Duc as a result of injuries sustained in an aeroplane accident at Gibraubal. Following some repairs to his machine, he started out on the Sunday evening to test it, and nothing more was heard of him until early next morning, when the machine was found wrecked with the pilot beneath it.

Another French Hydro-Aeroplane Competition.

UNDER the auspices of our French contemporary, *l'Aero*, another international competition for hydro-aeroplanes is being organised. It is proposed to have a race over the Seine from Paris to Rouen and back on October 13th, 14th, and 15th. The prize fund amounts to 20,000 francs, and first entries have been made by the Borel, Deperdussin, R.E.P., and Nieuport firms.

The Italian Height Record.

COMPARED with the world's record, the Italian altitude record is not very great, but it has been considerably advanced recently. On the 22nd, at the military aerodrome at Aviano, Lieut. Montanari on a Blériot increased it to 1,600 metres, while Capt. Bougiovanni on the same machine took a passenger up to 1,400 metres. Four days later the latter officer took up a passenger to 1,800 metres in 16 mins.

An Italian Fatality.

WHILE practising at the Mirafiora Aerodrome on Wednesday week an Italian officer, Lieut. Ragazzoni, had a fall and sustained fatal injuries.

The Russian Aeroplane Competition.

OWING to the fact that none of the entrants were able to complete the tests, it has been decided to postpone the Russian Military Aeroplane Trials until October 14th. On Saturday, Boutmy, on a Russian-built Nieuport machine, attained a speed of 104 k.p.h., and went up 545 metres in 7 mins. Khioni, on a machine of his own design and construction, did a speed of 101 k.p.h. It should be remembered that the competition is a national one and only open to Russian-built machines, but several German machines have been taking part *hors concours*.

The St. Petersburg Meeting.

IT has been decided to postpone the suggested flying meeting at St. Petersburg until next spring, when it will be held in connection with the flying race round the Russian capital and the fêtes to celebrate the tri-centenary of the reign of the Romanoff House.

Accidents to Spectators.

THREE persons have recently lost their lives while watching aeroplanes in flight. On Saturday a woman was killed at Aussig, in Bohemia, owing to an aeroplane propeller striking her head. She had been warned to move out of the way of the approaching machine, but made no attempt to do so. Her husband was also seriously injured. On the previous day, while Guillaux was passing near Amiens, an old man stopped in the middle of a level crossing at Renancourt to watch him, and was so fascinated that he failed to notice an approaching train which ran over him. A curious accident happened at Long Island Aerodrome, New York, on September 17th. George Morso was laying on the ground watching a fellow pupil, Salines, in the air when the latter started to come down. He made straight for where Morso was lying, and before the latter could jump up and get clear the machine had landed on top of him and inflicted such injuries that he died in the hospital a few hours later.

Four American Fatalities.

OF four aviators who met their deaths in America during the past week, Lieut. Longstaffe was fairly well known in this country, having learnt to fly at the Hewlett-Blondeau School at Brooklands, and put in some good work there. He had been to Mexico as a volunteer scout, but when the accident happened was giving exhibition flights at Hempstead, Long Island, N.Y. On Saturday, before starting to take up passengers he decided to make a trial flight, and went up on his biplane with his mechanic Chavellier. All went well until they commenced to descend, when seemingly the control wires jammed. The machine turned a somersault and dropped to the ground, Mr. Longstaffe being buried under the wreck. He sustained such injuries that he died in the hospital a few hours later, the mechanic, although badly hurt, will probably recover. The same day, in Maryland, Lieut. Rockwell and Corporal Scott, both pupils belonging to the U.S. Army Signal Corps, were making a descent when the machine crashed to the ground, killing both men. Two days previously Capt. G. L. Bambough fell at North Manchester, Indiana, and received fatal injuries.

AN ATTEMPT TO INVESTIGATE THE PHYSICAL PROPERTIES OF A TWISTED SKEIN OF RUBBER.

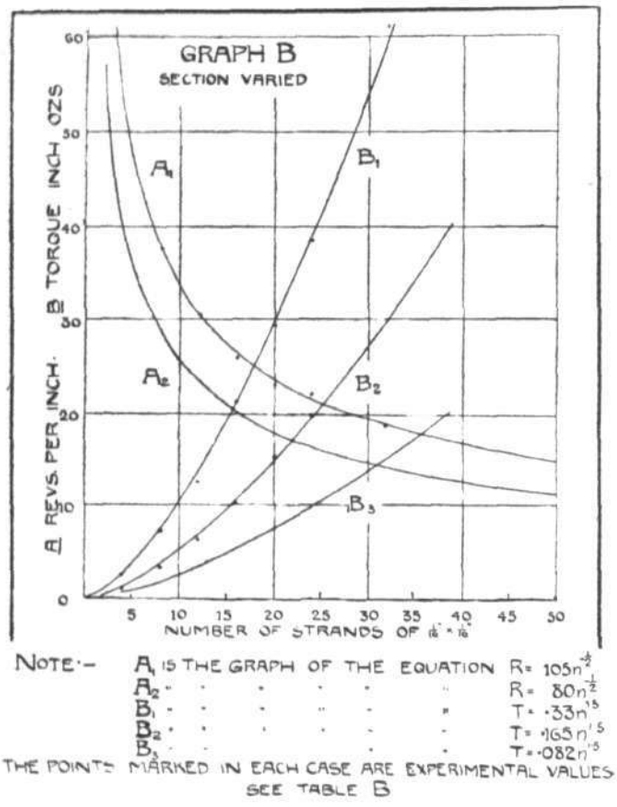
By W. W. HASTINGS RIDER and ALLAN P. HITCHENS, B.Eng. (Liverpool).

(*Concluded from page* 884.)

Series B.—i. To investigate a formula for the maximum number of revolutions that can be given to a certain skein, and

ii. To find a relation between the maximum torque and the number of strands employed.

For this experiment seven partial tests were carried out on seven different cables, containing respectively 4, 8, 12, 16, 20, 24 and 32 strands of $\frac{1}{16}$ in. square rubber cord, the cable being lubricated with



a well-known commercial liquid lubricant, and the number of revolutions required to fracture the specimen and the torque at fracture were tabulated.

A theoretical investigation had brought us to the conclusion that R varied inversely as $\sqrt{n}$ and so the graph of maximum revolutions against the number of strands was plotted, as was also that of the logs. of the variables. A straight line was obtained in the latter case, and hence it follows that the law is satisfied, the value of c being found as 105 approximately, and the value of the index being confirmed.

Obviously, the number of revolutions varies directly as the length of the skein, and so we may write $R = \frac{cl}{\sqrt{n}}$, or, transposing,

$$c = \frac{R\sqrt{n}}{l} \qquad (2)$$

where c is a constant depending on the quality and section of the rubber employed and the conditions of lubrication, stretch, &c.

Putting $n = 1$ and $l = 1$ we get $R = c$.

Hence c may be defined as the maximum number of revolutions obtainable from 1 strand of rubber 1 in. in length, under the given conditions.

But Table E shows the inadvisability of winding the cable almost to the breaking point, and the question at once arises—how far may we go? Our practical experience in this matter (extending over a period of four years) has shown that, for ordinary work, R must not be taken higher than $\cdot 75\frac{cl}{\sqrt{n}}$, but for competition purposes, R may be taken as high as $\cdot 9\frac{cl}{\sqrt{n}}$.

Now, from the already tabulated values of torque at fracture, the graph of T_F against n (the number of strands) was obtained; and as there was reason to believe that the maximum torque varied directly as $n^{1\cdot 5}$, we proceeded as in the previous case, and found that the graph of the logs. of the two variables was approximately a straight line, the values of the constants being ·33 and 1·5, respectively.

Hence we may write, $T_c = kn^{1\cdot 5}$, or $k = \frac{T_c}{n^{1\cdot 5}}$. (3)

Puttting $n = 1$, we get $k = T_c$.

Hence k may be defined as the torque at fracture of 1 strand of the given rubber under similar conditions.

TABLE C.—*Lubricant Varied. Partial Tests.*

Section 4 of $\frac{1}{16}$ in. sq., length 10 ins., stretch 5 per cent., weight ·07 oz.

No. of Experiment.	Lubricant.	Revs. R.	c.	End Pull. Ozs.	Torque at Fracture. T_F in.-ozs.	Mean Torque. ℓ in.-ozs.	$\frac{\ell}{T_F}$	Energy. E ft.-lbs.	E Lubricated	E Dry	Energy per lb. Ft.-lbs.
1	Dry	312	62	19	1·90	·80	·42	8·20	1·00		1800
2	Water	328	66	18	2·00	·82	·41	8·82	1·07		1900
3	1 per cent. C.S.	373	75	19	2·00	·80	·40	9·75	1·19		2120
4	5 ,,	482	96	—	2·00	·78	·39	12·30	1·49		2680
5	10 ,,	555	111	19	2·40	·91	·38	16·6	2·02		3620
6	20 ,,	607	121	19	2·36	·87	·37	17·3	2·11		3760
7	30 ,,	630	126	23	2·32	·84	·36	17·5	2·13		3820
8	50 ,,	667	133	23	2·50	·87	·35	18·9	2·28		4110
9	Soft soap ...	667	133	25	2·80	·95	·34	21·0	2·56		4570
10	66 per cent. C.S.	716	143	27	3·20	1·05	·33	24·7	3·00		5350

TABLE B.

The Equations $R = cn^{-\frac{1}{2}}$ and $T = kn^{\frac{3}{2}}$. *Section Varied. Partial Tests.* Length 10 ins., stretch 5 per cent., a commercial liquid lubricant.

No. of Experiment.	Section.	Weight. Ozs.	Values at Fracture ($c = 105$). Observed Revs. R.	Theoretical Revs. per Inch. $R_1 = 105n^{-\frac{1}{2}}$.	Observed Torque. T_F inch-ozs.	Theoretical Torque. $T_{F_1} = \cdot 33n^{1\cdot 5}$.	Mean Torque. ℓ_F inch-ozs.	Energy. E ft.-lbs.	Safe Values ($c_1 = 80$). Observed Revs. R.	Theoretical Revs. per Inch. $R_1 = 80n^{-\frac{1}{2}}$.	Observed Torque. T_{80} inch-ozs.	Theoretical Torque $= \cdot 165n^{1\cdot 5}$.	Theoretical Mean Torque $= \cdot 25\,T_{F_1}$.	$\frac{T_{80}}{T_F}$	Total Energy per lb. Ft.-lbs.
1	4 of $\frac{1}{16}$ in. sq.	·075	533	52·5	2·62	2·64	·97	16·9	406	40·0	1·16	1·3	·65	·46	3600
2	8 ,, $\frac{1}{16}$,,	·150	377	37·7	7·26	7·47	2·70	33·2	287	28·3	3·20	3·7	1·85	·44	3550
3	12 ,, $\frac{1}{16}$,,	·215	303	30·3	12·50	13·70	4·65	46·0	231	23·1	6·20	6·8	3·40	·49	3430
4	16 ,, $\frac{1}{16}$,,	·300	258	26·3	21·10	21·10	7·80	65·8	197	20·0	10·10	10·5	5·10	·48	3510
5	20 ,, $\frac{1}{16}$,,	·375	229	23·3	29·20	29·50	10·80	81·0	174	17·9	15·21	14·7	7·35	·52	3460
6	24 ,, $\frac{1}{16}$,,	·450	220	21·4	38·50	38·90	14·30	102·6	168	16·3	19·70	19·4	9·70	·51	3620
7	32 ,, $\frac{1}{16}$,,	·600	187	18·6	61·00	59·70	22·70	138·0	142	14·2	31·20	29·8	14·90	·51	3680 Full test

TABLE D.

Stretch Varied. Lubricant, soft soap. Distance between hooks, 10·5 ins.

Partial Tests.

No. of Experiment.	Section.	Length. Inches.	Stretch. Per cent.	Weight. Oz.	Revs. R.	Revs. per Inch of Original Length.	c.	End Pull. Ozs.	Average End Pull. Ozs.	Torque at Fracture. T_F in.-ozs.	Mean Torque. t in.-ozs.	$\frac{t}{T_F}$	Energy. E ft.-lbs.	Energy per lb. Ft.-lbs.
1	4 of $\frac{1}{16}$ in. sq.	10·00	5	·0735	649	64·9	130	25	—	2·90	1·015	·34	21·50	4550
2	4 ,, $\frac{1}{16}$,,	9·12	11·5	·0670	609	66·8	133	24	—	2·92	1·020	·34	20·30	4720
3	4 ,, $\frac{1}{16}$,,	8·40	25	·0618	547	65·0	128	25	—	2·83	·986	·34	17·60	4450
4	4 ,, $\frac{1}{16}$,,	7·14	47	·0525	475	66·5	133	26	—	2·93	1·040	·34	16·25	4700
5	4 ,, $\frac{1}{16}$,,	6·32	66	·0465	415	65·6	131	26	—	3·02	1·050	·34	14·25	4770
6	4 ,, $\frac{1}{16}$,,	5·83	80	·0428	385	66·0	132	28	—	2·95	1·033	·34	13·00	4720
7	4 ,, $\frac{1}{16}$,,	5·25	100	·0386	330	63·0	126	27	—	3·15	1·100	·34	11·85	4770
	Long hook used.					*Full Tests.*								
8	8 of $\frac{1}{16}$ in. sq.	5·25	0	·0781	225	43·0	156	43	15·4	7·6	3·06	·403	22·5	4600
9	8 ,, $\frac{1}{16}$,,	5·25	100	·0781	223	42·4	158	58	31·3	7·9	3·12	·395	22·8	4680

Note on Mean Torque.—Now, the energy stored in any cable = ·0327 Rt ft.-lbs.

But $R = \frac{cl}{\sqrt{n}}$.

Also the energy stored is proportional to the weight, and hence to the volume, which in turn varies as ln.

Therefore ·0327Rt varies as ln,

or $\frac{cl}{\sqrt{n}} \cdot t$,, ln,

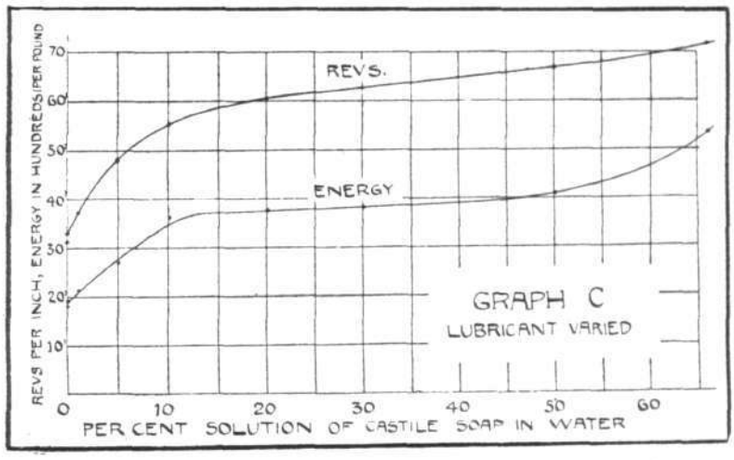
or t ,, $n^{1·5}$.

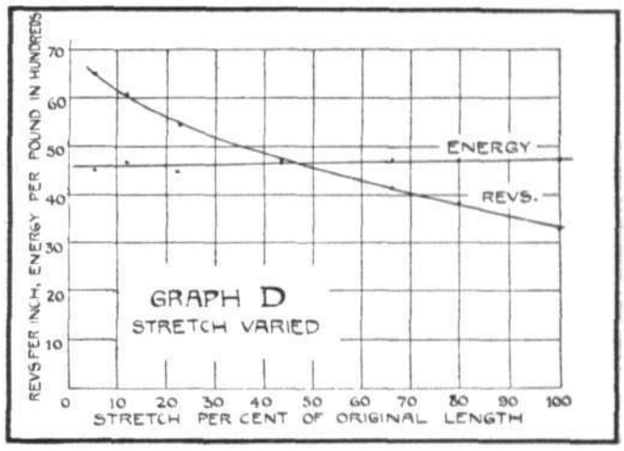
But series B proves that $T_F \propto n^{1·5}$ also. This suggests that there is a simple relation between T_F and t, and therefore the values of $\frac{t}{T_F}$ were obtained in each of the full tests of Series A (*see* Table A). It was found that this ratio averaged about ·43 for unlubricated rubber, and about ·37 for lubricated skeins.

As in ordinary practice R is generally taken as $·75\frac{cl}{\sqrt{n}}$, it was considered a matter of considerable utility to obtain expressions for the torque and energy stored up to this point, namely, $R = \frac{c_1 l}{\sqrt{n}}$ where $c_1 = ·75c$.

In the partial tests of Series B the ratio $\frac{T_{c_1}}{T_c}$ was obtained in each case, and it was found that, approximately, T_{c_1} equals one-half T (*see* Table B).

Now, in each of the graphs of T and R in the full tests of Series A, it was noticed on inspection that the mean torque over the range R = 0 to $R = \frac{c_1 l}{\sqrt{n}}$ was, approximately, half the torque at $R = \frac{c_1 l}{\sqrt{n}}$. This was confirmed by a very careful analysis (Table *b*).





Hence we may write $t_{c_1} = \frac{1}{2}T_{c_1} = \frac{1}{4}T_c = \frac{1}{4}T_F$.

But the energy stored in the rubber cable over the range R = 0 to $R = \frac{c_1 l}{\sqrt{n}}$ =

$$= ·0327 R t_{c_1}$$
$$= ·0327 \times \tfrac{8}{3} R_F \times \tfrac{1}{4} T_F$$
$$= ·006 R_F T_F \qquad (4)$$

TABLE E.

Successive Full Tests on Same Cable. Section 12 of $\frac{1}{16}$ in. sq., length 10 ins., stretch 5 per cent., weight ·223 oz.

No. of Experiment.	Lubricant.	Maximum Values. Revs.	End Pull. Ozs.	Maximum Torque. Inch-ozs.	Mean Torque. Inch-ozs.	Energy. Ft.-lbs.	Ratios. Per cent.	Energy per lb. Ft.-lbs.	Safe Values. Revs.	End Pull. Ozs.	Maximum Torque. Inch-ozs.	Mean Torque. Inch-ozs.	Energy. Ft.-lbs.	Ratios. Per cent.	Energy per lb. Ft.-lbs.	Remarks.
1	50 per cent. CS ...	315	60	13·00	5·80	60	100	4300	240	41	7·90	4·14	32·5		2330	New cable I fractured.
2	50 per cent. CS. Dries too rapidly	320	48	9·72	4·44	46		3300	240	31	5·21	3·15	24·7	100	1770	New cable II not fractured.
		319	44	7·80	3·73	39		2800	240	29	4·88	2·80	22·0	89*	1580	1st rewind No. II fractured.
									240	29	5·74	3·10	24·3	100	1750	New cable III to safe limit only.
3	Soft soap								240	19	3·68	2·34	18·4	76*	1320	10th rewind No. III to safe limit.
		399	53	11·00	3·40	44·4	74	3150	240	17	3·58	2·24	17·5	71*	1250	20th rewind No. III fractured.

Having verified the above three laws (see formulæ 2, 3 and 4) we see that by carrying out *one* experiment on any cable of convenient section and length, the constants c and k may be found; and substituting these values in the above formulæ the maximum and safe number of revolutions, the maximum and safe torque obtainable, and also the approximate energy over the whole range or up to the safe working limit can be determined for *any size* of cable of the same rubber, under similar conditions of lubrication, stretch, &c.

Series C.—To ascertain the effect of lubrication on a certain skein of rubber.

In the general table are given the results obtained in tests of six different unlubricated skeins of rubber, and also those obtained for similar skeins when lubricated. These tests showing the importance of lubrication, a further investigation was carried out to ascertain more definitely its effect. Although the section chosen was small (four strands of $\frac{1}{16}$-in. sq.) the results for this small section may, in view of the similarity of the graphs of the full tests in Series A, be taken as quite reliable. The first skein was tested dry, the second was lubricated with water, and all the others with solutions of white powdered Castile soap in water, excepting No. 9, in which the lubricant used was ordinary green soft soap, obtainable at any chemist at about 1½*d*. per oz. The ratio of the energy stored in any lubricated skein to that stored in the dry skein was found in each case—*see* Table C. Reference to this table will show that when the Castile soap lubricant was of 10 per cent. strength, the energy stored was double, and when 66 per cent. the energy was treble that stored in the dry skein. A further result noticed on examination of the fractured cable was, that whereas the strands of the unlubricated cable were badly stuck together, and scarred and cut in several places, those of the lubricated cable showed not the slightest tendency to stick together, and there were no subsidiary cuts whatever.

Series D.—An investigation as to the effect of initial stretch on a given skein of rubber.

It has been frequently stated in the correspondence columns of FLIGHT that it is desirable to give the rubber cable considerable initial stretch and so, in order to ascertain what is the effect of this stretch, seven partial and two full tests were carried out, the initial stretch varying from 0 to 100 per cent. The maximum values for the revolutions, torque and end pull were observed, and, together with the energy stored, entered in Table D.

These experiments revealed the surprising fact that the only result of an initial stretch is to increase the average end pull—the values at fracture for the revolutions per inch of original length, torque and energy stored not changing to any material extent. Therefore any initial stretch beyond the 5 per cent. or 10 per cent. allowed for the permanent strain of the rubber is inadvisable, since such stretch involves the use of a longer motor and consequently increases the weight of the model.

Series E.—To ascertain the deterioration due to continued use of a twisted rubber motor.

First a full test on a skein consisting of twelve strands of $\frac{1}{16}$-in. square cord was conducted in order to ascertain the constants, and then the following two experiments were made.

i. In this, a cable similar to the above was wound up almost to the breaking-point; and then unwound and rewound up to fracture, a full test being conducted on each wind. This experiment showed that winding the rubber almost to fracture permanently injures it, the energy stored in the range R = 0 to R = 240 (safe working limit) being reduced to 90 per cent. on the second wind.

ii. In this test a similar cable was wound up to 240 revolutions (about three-fourths of the maximum), and then unwound, and this repeated twenty times, the twentieth rewind being carried to fracture, and full readings being taken on the first, tenth, and last winding. The results of this experiment showed that the energy stored over the above range is reduced on the tenth rewind to 76 per cent., and on the twentieth rewind to 71 per cent. of its original amount. From this it may be assumed that after a fair amount of use the energy would drop to about two-thirds of that stored in the first wind, and this result is confirmed by our own experience with models. We have further noticed that if the rubber has, say, a week's rest, the energy stored rises to about four-fifths of its original value, but such recovery is only temporary and disappears after the first wind.

The following notes, although outside the original scope of the experiments, are yet of considerable practical utility to model aero experimenters.

Note on End Pull.—The question of end pull is one that has considerable effect on the design of model aeroplanes, owing to the fact that the main strut or struts must be made strong enough to withstand it. With regard to this question the results obtained were rather disappointing, but as a rough guide it may be said that other things being equal the maximum end pull varies as the area of cross section (for actual valves, *see* tables). The average end pull seems to vary with the amount of stretch, being doubled by stretching to twice the original length. Where the amount of initial stretch is small, the end pull at the safe working limit is very nearly two-thirds of the value at fracture.

Note on the Various Sections of Rubber.—The whole series of tests showed that there is not much to choose between the various sections of rubber provided those sections are rectangular. Rubber of circular section is, owing to its process of manufacture, unsuitable as a motive power for aero models. Cables composed of a single strand are also undesirable as, although when dry they fracture in the regular manner, when lubricated they generally cut at the knot tying the loop at either end before final values can be reached. This remark applies also to cables containing an odd number of strands.

THE KITE AND MODEL AEROPLANE ASSOCIATION.

OFFICIAL NOTICES.

British Model Records.

Hand-launched	Distance	A. E. Woollard	477 yards.
	Duration	A. F. Houlberg	89 secs.
Off ground	Distance	F. W. Jannaway	84 yards.
	Duration	G. Rowlands	30 secs.
Hydro, off water	Duration	G. P. Bragg-Smith	25 secs.
Single-tractor screw, hand-launched	Distance	H. R. Weston	84 yards.
	Duration	F. W. Jannaway	11 secs.

Competition, held on September 28th, on the 100-Acre Field, Greenford, for single-tractor screw models, duration and stability, rising off ground. Prizes: 1st, George III drinking-cup (presented by Col. Fullerton); 2nd, silver medal of the Association (also a Mann monoplane, presented by Messrs. Mann and Grimmer); 3rd, bronze medal of the Association. The results were as follows:—1. J. Dollittle, 88 marks; 2. H. R. Weston, 64; 3. F. W. Jannaway, 29. Judges: Messrs. V. E. Johnson, M.A., G. P. Bragg-Smith and E. W. Twining. Considering the gale blowing, the flying was good, and was a severe test for stability.

Official Flights.—The first official trials for tractor screw models took place after the above competition, and, owing to the gale increasing, the models had to be hand-launched. Results: H. R. Weston, 84 yards; J. Dollittle, 52 yards; F. W. Jannaway, 11 secs. The above are after allowance has been made for wind velocity.

Lecture.—The first lecture of the winter session will be given by Col. S. F. Cody, on November 7th, on behalf of the first war kite squadron's equipment. The lecture will be on "What the nation should do to stand first in aviation," and the place will be announced as soon as possible. All members are requested to apply for tickets for disposal among their friends. Members will have tickets for themselves forwarded free on application.

Kite Display.—The kite display fixed for to-day has been postponed, but any member who would like to practise with their kites will be welcomed at The Plumes Hotel, Park Royal, at 3 p.m., or to assist with the Baden-Powell team. The reason of the postponement is that the letter from the County of London Territorial Association was not received in time to make suitable arrangements.

27, Victory Road, Wimbledon. W. H. AKEHURST, Hon. Sec.

MODEL CLUB DIARY AND REPORTS.

CLUB reports of chief work done will be published monthly for the future. Secretaries' reports, to be included, must reach the Editor on the last Monday in each month.

Aero-Models Assoc. (N. Branch) (15, HIGHGATE AVENUE, N.).
OCTOBER 5TH. Flying at Finchley.

Aldershot Aero Club (37, ALEXANDRA ROAD).
OCTOBER 5TH. Flying, 2.30. October 6th, 11 a.m.

Blackheath Aero Club (48, HAFTON ROAD, CATFORD, S.E.).
OCTOBER 5TH. Flying, Grove Park and Blackheath.

Croydon and District Aero Club (Sec., 136A, HIGH STREET).
OCTOBER 12TH. Open duration contest, Wimbledon Common, 4 p.m. (prizes).

Hendon Model Aero Club (8, MONTAGU ROAD, W. HENDON).
OCTOBER 5TH. All-round contest (trophy).

Leytonstone and Districts Aero Club (64, LEYSPRING ROAD).
OCTOBER 5TH. Meeting, Wanstead Flats, as usual.

Paddington and Districts (77, SWINDERLY ROAD, WEMBLEY).
OCTOBER 5TH. Sudbury Hill. Tractor competition (Johnson cup and 2nd and 3rd prizes). October 12th. Duration handicap (prize).

Scottish Ae.S. (Model Aero Section) (3, STANMORE RD., GLASGOW)
OCTOBER 5TH. Hydro-aeroplane meet, the pond, Maxwell Park, Pollokshields. October 12th. R.o.g. contest. For venue *see* notice board.

Stony Stratford and District Aero Club (OLD STRATFORD).
OCTOBER 5TH. Impromptu contests, Blackhorse ground, Old Stratford. October 9th. General meeting, 8 p.m.

Yorkshire Ae.C. (Model Sec.) (53, WEST STREET, LEEDS).
OCTOBER 5TH. Hydro-aeroplane meeting, 3.30, small lake, Roundhay Park.

Models

Conducted by V. E. JOHNSON, M.A.

The Scientific Aspect of Model Aeroplaning.

WE desire to call the reader's attention to the articles in this week's and last week's issue on "An attempt to investigate the physical properties of a twisted skein of rubber," an admirable piece of work, and one which clearly shows that there are not wanting those who are fully prepared to undertake really serious, patient and systematic work and study in the interests of model aeroplaning. We sincerely trust it may serve as an inspiration to others to attempt and carry out similar work. The debt which model aeroplaning owes to *individual* as contrasted with *concerted* effort can hardly be over-estimated. The *average* club modellist seems to care about nothing save to make his "flying stick" keep in the air five seconds longer than some other member's, or fly six yards further; as for any concerted effort on the part of any club to seriously attack any one of the numerous problems still awaiting solution, we regret to be compelled to say that we have never heard of such. There are one or two points in the article to which we would like to call attention. In series E it would be very interesting to know the effect of a time interval (not less than two days) on the partial recovery of rubber after the *initial* wind. The authors do not make the conditions very clear under which the rubber was given a week's rest, *i.e.*, to what previous tests it had been subjected. Referring to their note on end pull, the difficulty is not really from end pull *per se*, but from this *combined* with the torsional force exerted by the twisted rubber that necessitates skilful building. With regard to the note on the various sections of rubber the reader should refer to Mr. T. W. K. Clarke's remarks, February 17th issue. The writer's experience is that weight for weight more energy can be stored in the strip than in the square sectioned, but that the latter has the longer life. Compare also the amount of energy that can be stored in a pound weight of rubber as found in the foregoing experiments with that as determined by Mr. G. T. R. Hill (February 17th issue).

Model Club Notes.

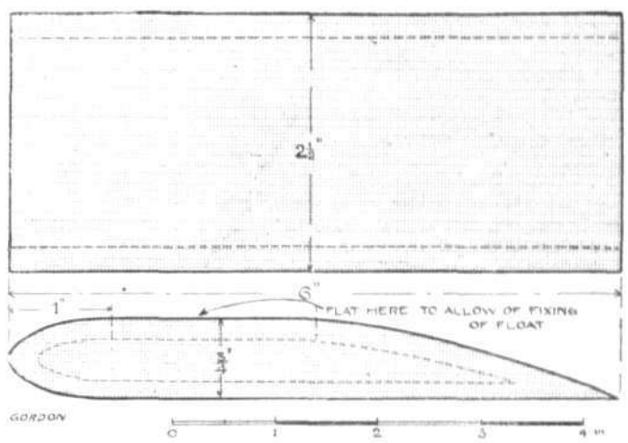
Owing to the extremely uninteresting nature of these notes so far as the ordinary reader is concerned, it has been decided to publish them monthly only, the notes to be a *resumé* of the *work* done. Club members will be notified of forthcoming events by means of a brief weekly calendar showing dates of forthcoming competitions, &c. We might just mention incidentally that something in the nature of a more serious and combined effort on the part of club members will be expected in the future than in the past if these notes are still to appear in FLIGHT, and also that more care and trouble should be taken in the drawing up of the same.

Mr. A. Richardson's Model.

We give, this week, two illustrations of a model designed and built by Mr. A. Richardson (Westcliff-on-Sea). The length over all is 23 ins., and span 27 ins. The model is built mainly of whitewood, cane, and silk. The builder states that he is about to fit a small electric motor to the same, and hopes for some success, as the model is a good glider. We trust Mr. Richardson will not waste his time over any such useless device. The especial interest which attaches to this model is that the maker is so unfortunate as to possess only one hand, the model, nevertheless, being entirely constructed by him without any assistance.

Model Hydro-Aeroplane Floats.

Mr. J. S. Gordon, of the Scottish Ae.S. Model Aero Club—a club which is well known for the attention it has devoted to model hydro-aeroplanes—sends the following communication and accompanying sketch: "I have been continuing my experiments with floats, and up till now I find that the models get along and off quicker when the floats are made with a span narrower than the chord dimension. Plan and section of float shown to scale. Size being 6 ins. long; 2½ ins. wide (span); ⅜ ins. deep at 2 ins. from the leading edge.

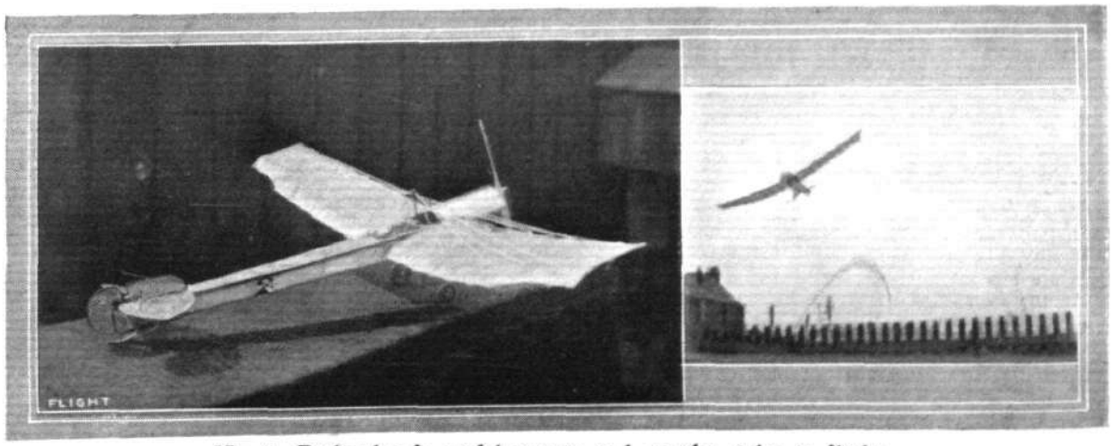


HYDRO-AEROPLANE FLOAT FOR MODEL.—Weight ½ oz., supports 4 ozs. net (actual test).

By the formula I sent recently it should support 3½ ozs. In reality it supports 4 ozs., while 5 ozs. makes it sink slowly to the bottom."

It will be noticed Mr. Gordon's float weighs ½ oz. and supports 4 ozs.; for the weight supported the float is somewhat heavy. On testing one of my own floats, shown in section, &c., July 6th issue, the weight is exactly ½ oz., size, 6 ins. by 6 ins. This float supports 8½ ozs., slowly sinking with 9 ozs. Another stepped float 9⅜ ins. long by 2⅞ wide, average depth ½ in., weight also ½ oz., slowly sank with 5⅜ ozs.

Two larger floats, just completed for a steam-driven model, 6 ins. wide by 24 ins. long, and which weigh 4 ozs. each (approx.), were found on trial to be capable of holding up 3 lbs. and 3½ lbs. respectively. They were, it is hardly necessary to state, of somewhat stouter build than the smaller floats. The above weights are



Mr. A. Richardson's model at rest, and, on the right, in flight.

exclusive of the weight of the floats. Referring to my model recently illustrated in FLIGHT it may interest Mr. Gordon and others to know that the longest flight duration made by this model is (approx.) 30 secs. Mr. Gordon asks for our opinion on the matter of ratio between span and chord in the matter of floats. In reply, we think more experiment is necessary before expressing an opinion on the matter, it must, however, always be carefully borne in mind in all questions affecting hydro-aeroplanes that the machine, to be a success, must be efficient as a flying machine as well as a hydroplane.

Mr. W. P. Dean's Rule for Rubber Motors.

In a communication which we have received from Mr. Dean, he says :—" Let me state that I never worked to a hard and fast rule, but I realise how helpful such might be, and my rule was only a suggestion to cover models which are now in hand, including control devices, hydro-aeroplanes, &c. [We certainly did not interpret the rule in this manner, but as referring to hand-launched models, and we believe our correspondents did the same.] The flying-stick type has already been exhausted, and the 8-in. and 9-in. diam. propeller motor with six strands is now out of date. But let me remind your readers that Mr. Fleming Williams' first "quarter-miler" carried 34 strands of $\frac{1}{16}$-in. sq. rubber to each 13-in. propeller, and I copied him in 1910 with great success. Yet I have a 1$\frac{3}{4}$-oz. model with 8-in. twin propellers which is a good flyer with only 4 strands of $\frac{1}{16}$-in. sq. rubber. Each propeller weighs 28 drams, and is only $\frac{3}{4}$ in. wide (carved from American whitewood).

Mr. A. B. Clark's ABC 76.

Referring to our remarks *re* the wheels used with the above model (see September 21st issue), Mr. Clark writes : "The wheels fitted were taken off a 6$\frac{1}{2}$*d.* toy motor, but I shall use T. W. K. Clarke's on my biplane, as suggested by you. Last week I was flying the model with a four-bladed screw, but could only obtain some 120 yards. There is a marked difference in the flying when using the '4' and when using the '2.' The former seems to pull her along with more certainty, although the duration is not so good, as I have to use another strand of rubber." [Experiments of this kind with other than two-bladed propellers are full of interest. We trust to hear more of them, and that Mr. Clark will not be alone in his experiments.]

Mr. W. J. Williams' Hydro-Aeroplane.

In reply to our query in last week's issue Mr. Williams informs us that the centre of gravity is situated half an inch in front of the main plane.

Query.

A. E. BARLOW wishes to know the motive power of Mr. Horner's model and the make of his propellers.

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An Aero Show at Olympia next February.

IT is now officially announced that the Society of Motor Manufacturers and Traders will hold an Aero Exhibition under the auspices of the Royal Aero Club at Olympia next year, and that the date will be some time during the month of February.

British Pilots Mounting Up.

EVERY other week sees a large batch of new pilot certificates granted by the Royal Aero Club, and it will be observed from the official notices on page 894 this week that the twelve certificates granted at the last Committee meeting brings the total to 313.

A New British Altitude Record.

OFFICIAL recognition has just been accorded by the Royal Aero Club to the splendid high flight of Mr. G. de Havilland, with Major Sykes as passenger, on the military biplane BE 2, at Salisbury Plain, on August 12th. It has been passed as a British altitude record, the actual figure being 10,500 feet.

The Scottish Naval Aviation Base.

THE organisation of the naval aviation centre at Carlingnose, near Forth Bridge, has now been practically concluded, and the three hangars are tenanted by two Short and one Farman hydro-biplanes. At the beginning of the week Commander Samson, Capt. Gordon, and Lieut. Hewlett were at Carlingnose, but were unable to do any flying owing to the bad weather.

America Exporting Aeroplanes.

ACCORDING to figures published by the U.S. Department of Commerce and Labour, 27 American-built aeroplanes valued at $105,805 were exported during the fiscal year ending June 30th last, while 17 machines valued at $59,713 were imported.

Replies in Brief.

R. H. HUTCHINGS.—The account of the model gliding experiments which you send is very interesting—but the model is on far too small a scale to deduce any results of practical value. We should be extremely interested to know how a model of the last type mentioned by you behaved—the *linear* dimensions of which were six times those you mention.

F. J. CLEARE.—We are much obliged for the photos sent, and glad to learn that FLIGHT has proved of so much use to you. You do not state the total weight of your model. Your floats are heavy for the weight supported. Use Jap silk instead of aluminium foil. Damp it well before gluing it on, and it will dry as tight as a drum ; give two coats Bragg-Smith varnish. If using a proofed silk *soak* in water for an hour or so before putting on (mere damping is not sufficient), and it will also dry taut. In reply to your query, try Messrs. Bonn and Co., or Messrs. T. W. K. Clarke and Co. Your machine being of the tractor type (at present unusual in this form), we should much like, for publication, a snapshot taken of it when in actual flight.

V. L. ADDISON.—In the account and photos you have been good enough to send, you have omitted to state the *weight* of rubber, duration and length of flight. We shall be pleased to give brief account of same later on receiving above. A photo (separate if you like), showing landing chassis, would also be acceptable. Are both models of the same *type* ?

GORDON JONES.—We have not yet received promised particulars and photos or drawings.

H. T. HOLMAN.—Apparently you launched the model *in excess* of its soaring speed. You do not state what it does if wound up and placed on the ground and allowed to rise of its own accord. If it does the same thing try the main plane further back. You should not point a model upwards when launching it, or only very slightly so, not at all if against the breeze. If such a model rises too steeply it invariably side slips and dives.

E. T. TOWNSEND.—Your query is answered elsewhere in this section, see remarks in "The Scientific Aspect of Model Aeroplaning."

L. G. RYLEY.—Photographs and drawings to hand, and we trust to be able to make use of same later. In reply to your queries, your floats should be capable of supporting about twice the total weight. We do not think you will require to make any difference in the angle of incidence if your base is wide enough, viz., nearly half your span. You will invariably find such a model will fly better with a propeller of one pitch than the other (*i.e.*, right or left-hand), which can only be found out by experiment.

R. B. STEELE.—An expert aeromodellist generally tests his machine by gliding it and then sometimes with, say, 50 per cent. of maximum normal turns—but often with the full number straight away. We should suggest your raising your percentage to 50 or 60. Your model is clearly slightly over-elevated, you might try one strand less rubber.

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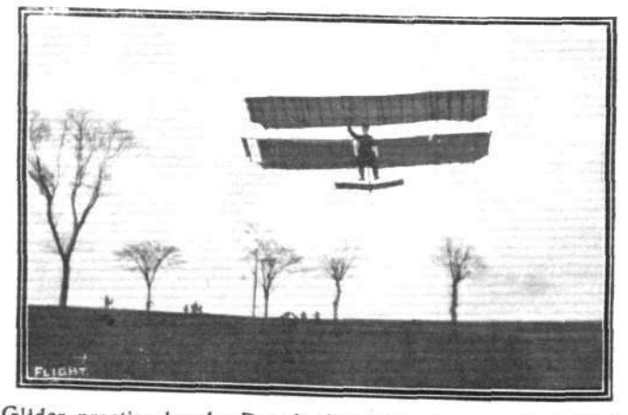
A Dollar a Trip in New York.

ACCORDING to the latest advices from New York there has been a very considerable drop in charges for passenger trips on aeroplanes. Three years ago the regular "fare" was between $400 and $500, but now at Minneola the recognised "hops" are being run for $1. True the passenger does not get a very lengthy experience, nor is he often taken very high, but then the demand is great and the flyers are kept constantly on the wing.



Glider practice by the Dansk Amateur Aeronautical Club (Copenhagen) at their Bispebjerg grounds.

CORRESPONDENCE

**** *The name and address of the writer (not necessarily for publication)* MUST *in all cases accompany letters intended for insertion, or containing queries.*

Correspondents communicating with regard to letters which have appeared in FLIGHT, would much facilitate ready reference by quoting the number of each letter.

Momentum in Air.

[1635] In the interesting discussion on some of the side issues arising out of the Military Trials in your issue of August 31st, the writer suggests that a machine that has no speed relative to the earth has no momentum. Surely it is not a question of its speed relation to the earth, but to the medium from which it obtains its reaction. The writer goes on to suggest that, in the case of a machine flying against a wind of its own speed, if the air were suddenly to become calm the machine would fall. In my view, the machine would possess momentum, and show it by instantly rushing forward at a speed equivalent to that of the wind which had suddenly disappeared. I mean assuming that the engine is at that moment cut off.

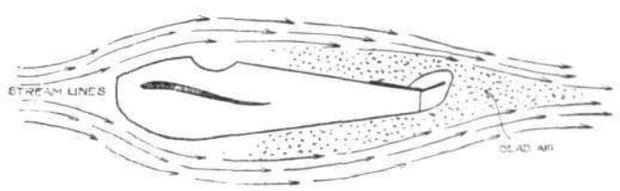
Royal Aero Club. C. PAUL WILLIAMS.

[We deal with the point raised on page 897.—ED.]

Stream-lining the Rudder.

[1636] It has occurred to me that a monoplane with a bluff, streamline body of the Nieuport type, will be very liable to refuse to answer to the elevator at the finish of a dive because the body is designed to be efficient at a given speed. If this speed is exceeded the air "streamlines" flow clear of tail and elevator, which consequently work in the "dead air," caused by the rapid passage of the body. Perhaps a small sketch will make my meaning clear.

In corroboration of these statements one could cite the accident to Capt. Loraine, which was caused by a dive following on a side-slip,



when the pilot could not, apparently, straighten the machine out in time.

Perhaps some of our aviators who have piloted this type of machine could come forward and say if their views agree with mine.

Loughborough Junction. WILLIAM HOOPER.

Gyroscopic Force.

[1637] I have just read your foot-note to my letter, published in your issue of August 24th, in which you say that I asked for a commission to pass on a question that I had already decided. Without intending to, perhaps, you have hit it exactly. Certain makers of a certain revolving motor recently gave out for publication what they claimed was the results of a test put on their motor to ascertain just how much danger is caused on turns by gyroscopic force. According to this report, there is scarcely any danger at all. Now, I claim that there *is* danger in all revolving cylinder motors and simply request that a commission be appointed to decide who is right. Please allow for the sake of fairness, or at least in the interest of safer flying, that my claim may be right.

One of our aeronautic journals published reports on the Quimby-Willard accident, written by four eye-witnesses, all of whom are considered authorities on the subject of aviation. Seven different causes were given, no two of them agreed and two of them said that perhaps the *real cause* would never be known.

225, So. Wabash Ave., THOMAS PRESTON BROOKE.
Chicago, U.S.A.

Tractors *v.* Loaded Elevators.

[1638] The recent regrettable accidents which have happened to certain members of the Royal Flying Corps and others, and the Government ban (temporary or permanent) on the monoplane again brings to the fore the problem of stability and also the question of the particular type of machine on which all the accidents have taken place—viz, that they were *tractors*—as well as being monoplanes. Now I have many reasons for believing that there are a great many readers of FLIGHT who would gladly welcome a discussion on the question of the relative inherent stability of the two types—the tractor (propeller in front) and the loaded elevator type. We have many instances of the former—of the latter we have the Cody and the Valkyrie and some others—all machines which have without doubt been the subject of much criticism from an engineering point of view—but which *as a type*—has never so far as I am aware been shown to be in any way deficient in stability. I am referring here more of course to longitudinal stability—although a deficiency in one always means a loss in the other as well. So far as I am personally concerned I can only claim to express an opinion in the case of models; by models I mean power driven models weighing pounds not ounces and models in which the distribution of weight is practically the same as in full-sized machines. In every case—rubber or power driven—the result is the same as proved not by one experimentalist but by hundreds, not by dozens of experiments but by thousands, viz., that the loaded elevator type has by far the more inherent stability—or as this statement as it stands may be open to much criticism—I will put it in another form, viz., that the loaded elevator type posses a stability far easier of attainment than the tractor type. The loaded elevator type model is "fool proof"—even more so if twin propellers be used, for then all gyrostatic influences (which *do* exist—markedly at times even in the case of models) at once disappear. Only an expert aeromodellist can build a successful tractor model—and even he does not always succeed. If the answer to this is not that the loaded elevator type *does* possess more inherent stability—what is the answer? There must be one. I do not refer in the foregoing to certain foreign full-sized machines with a small plane *in front*—but solely to type stated—the *loaded* elevator type.

I could add very considerably to the above but would much rather others "rolled the ball along."

V. E. JOHNSON.

The Danger of the Vertical Rudder.

[1639] Mr. R. Brocklehurst's letter on this subject and your editorial on "The Elevator Action of the Rudder" serve to point out a remedy for what is obviously, under certain conditions, a serious danger. It is clear that experiments should be conducted with a system of rudder and elevator designed to swivel together about the long axis of the tail of the aeroplane and in such a manner that the elevator remains horizontal and the rudder vertical whatever the tilt or banking of the machine. Such a system could be arranged on a sleeve rotating on a bar or tube, or, if the system and tail are of large sectional area, the swivel could be arranged like the turntable of the forecarriage of a cart. I refrain from sending a sketch because it might be the means of preventing the granting of a patent. The degree of swivel action would have to be proportional to the amount of rudder or elevator action and to the warp, and there is no obvious reason why this cannot be simply arranged by gearing up some of the wires for these purposes to the swivelling system. Suitable stops to prevent over swivelling would be necessary.

Aberdeen, September 24th. G. H. COLT.

Gyroscopic Force in Aviation Accidents.

[1640] In one of your recent issues you published a highly interesting letter (1612) by the pen of Mr. Thomas Preston Brooke, of Chicago, in which my name is repeatedly mentioned in connection with the subject of Gyroscopic Action in motors. Mr. Brooke, however, rather over-estimates the importance of my work along that line, such work having been limited merely to the publication of a few articles and one or two lectures in which I broached the subject, beside a few private experiments with extremely crude "home-made" apparatus.

In explanation of Mr. Brooke's letter and also on my own behalf I wish to state that I fully share his views as to the importance of the effects of gyroscopic action in aeroplanes and the folly of neglecting it or ignoring its presence as it is done at present. I am firmly convinced that eighty per cent. of all aeroplane accidents are due to the effects of this action not having been taken into account, either in the construction or operation of the machine. Sudden breakages, giving way of stays and bolts are (to my mind) largely to be accounted for by the stresses generated by gyroscopy.

As I pointed out and explained at some length in the article mentioned by Mr. Brooke (*Fly*, Philadelphia, April, 1912) the couple of precession, or rather its presence, can be distinctly felt even in an automobile. That this is true and that the fact is recognised in a general way may be realized when we remember that

all motor races are run in such a way as to eliminate right-hand turns wherever possible. Now if the effects of gyroscopy are such as to influence the steering of a heavy vehicle with a solid foundation beneath it and equipped with a motor running at comparatively slow speed, of what enormous importance must they become in a light body *with no fixed support* to react against, and with a motor running at over 1,000 r.p.m.

Mr. Brooke's letters (one published in FLIGHT and one in *Aero*) were occasioned by the appearance in one of the American journals of an alleged description of certain experiments made by M. Laurent Séguin, with a view of determining the amount of weight necessary to counterbalance the gyroscopic action as presented by his Gnome motor, the result (as stated) being that the force was found to be practically negligible. Now I beg to call attention to the fact that if Mr. Brooke by reason of having designed a non-gyroscopic motor is not an unbiased judge, as he himself admits, then M. Séguin certainly cannot be one; without for a moment doubting his integrity as an engineer or the sincerity of his experiments, yet his findings along that particular line of investigation cannot be accepted as final by a body of scientific men.

Therefore I may say that the course suggested by Mr. Brooke of having this matter fully investigated by a body of competent men is an excellent one and one that deserves full support from the technical press. Whether it should be left to the care of the Aero Club of America, as he suggests, is a matter open to discussion. In any case, I trust that the result of such investigation will turn out to be an "eye opener" to many of us.

I regret to have been unable to secure a copy of FLIGHT with M. A. Kapteyn's article. The subject was first brought to my attention by a lecture he held as far back as March 13, 1909, at the Royal Dutch Engineering Society, of which I have the honour of being a member. Even then he pointed out the dangers lurking in a rotary motor, and his subsequent investigations have undoubtedly made him one of the greatest authorities on the subject.

In concluding, let me state that I have never met Mr. Brooke and have no connection of whatsoever kind with his enterprises. Thanking you for the kindness for giving this a place in your columns.

BARON C. ADRIAN VON MUFFLING.

Brooklyn, N.Y., U.S.A.

Balloon Ascents and Midland Facilities.

[1641] With reference to the very interesting article by Mr. Griffith Brewer in current issue of FLIGHT, I would like to point out that Mr. Radley's "Meteor" started from the grounds of the Midland Aero Club at Dunstall Park, where the club have had specially laid on a 12-in. gas supply for inflation purposes.

From actual experience I can heartily endorse Mr. Brewer's remarks about the advantage of Wolverhampton as a centre for ballooning. As he points out, Wolverhampton can be reached by North-Western or Great Western Railway in 2½ hours from London, and being in the centre of England one makes sure of a good trip with plenty of land in whatever direction the wind may be blowing. The ground itself is ideally situated for ballooning, with a turf surface many acres in extent, where one could fill and get away in perfect safety in any sort of wind.

The Midland Aero Club would be very pleased to grant facilities for ascents from their grounds to members of recognised clubs, and will render every assistance possible in making all the necessary arrangements.

GILBERT DENNISON, Hon. Secretary, Midland Aero Club.

Grand Hotel, Birmingham.

"Practical" Aero Clubs.

[1642] In your reply to Douglas Stewart, page 885, September 28th issue, you state that there *appears* to be very little gliding going on, and you also deplore the fact that the number of "practical" aero clubs is practically nil. Unfortunately, this is the state of things at present. But if Mr. Stewart or any other of your numerous readers would like to join a "practical" aero club, with headquarters in London, whose members have done a good deal of gliding, and the annual subscription of which is really nominal, viz., 5*s.* (no entrance fee), the undersigned will be pleased to forward particulars concerning same on receipt of a card. The club in question, The Polytechnic Aero Club and Flying Society, owns two Weiss gliders, presented by Mr. José Weiss, a Wright type biplane glider, presented by Mr. H. Vaughan, and a 44 ft. span "portable" monoplane built at the Poly. The Wright especially has done a good deal of valuable service during the summer, and most successful week-end meetings have been held.

The club has its headquarters at the Polytechnic, Regent Street, W., where technical and practical classes are held during the winter evenings.

This is the kind of club which deserves every support, but the "Poly. Ae. Club" not having courted publicity, is not very well known, and consequently not appreciated. We hope, however, to do big things in the future, and anyone joining now will be in time to start evening classes in "Aeroplane Drawing and Design," "Aeroplane Construction and Aero Workshop Practice," "Aerodynamics," &c.

Thanking you for the valuable knowledge derived from a weekly perusal of your valuable paper.

Regent St., W. W. H. EMERTON, Hon. Gen. Sec.,
The Polytechnic Aero Club and Flying Society.

PUBLICATIONS RECEIVED.

Announcements, Educational and Social, for the Session 1912–13. The Northampton Polytechnic Institute, St. John Street, E.C.

Petrol Engine Construction and Drawing. By W. E. Dommett, Wh. Ex., A.M.I.A.E. London: Edward Arnold, 41–43, Maddox Street, W. Price 3*s.* net.

Famous Airmen and their Equipments; with some Notes on First-Aid in Emergencies. London: Burroughs, Wellcome and Co.

Apprecier un Aeroplane, l'ameliorer s'il y a lieu. By Capt. du Genie Duchene. Paris: Librairie Aeronautique, 40, rue de Seine. Price 1 fr. 50.

NEW COMPANIES REGISTERED

British Aero and General Assurance Agency, Ltd.—Capital £500, in £1 shares.

British Rotary Motor (Aviation) Co., Ltd., 137–138, High Street, Bromley, Kent.—Capital £5,000, in £1 shares.

Coventry Auto-Aero Co., Ltd.—Capital £2,000, in £1 shares.

Integral Propeller Co., Ltd., 307, Euston Road, N.W.—Capital £1,000, in £1 shares.

Aeronautical Patents Published.

Applied for in 1911.

Published October 3rd, 1912.

27,770. E. W. WAKEFIELD. Hydro-aeroplanes.

Applied for in 1912.

Published September 26th, 1912.

8,808. L. C. J. HAREL. Supporting surfaces of aeroplanes.
14,080. H. H. ELLIOTT. Aerial propellers.

Published October 3rd, 1912.

3,498. C. M. OLMSTED. Aerial propellers.
4,589. BOLLEKENS FRÈRES. Mounting and dismounting aeroplanes.
10,358. L. L. CLEMENT. Aeroplanes.

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